WASTE ALLOCATION WORKSHOP REPORT

ONTARIO WASTE MANAGEMENT CORPORATION

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DECEMBER 1988

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9 January 1989

Ontario Waste Management Corporation
2 Bloor Street West
11th Floor
Toronto, Ontario
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Attention: Mr. J.G. Micak
Manager - Environmental Projects

Waste Allocation
Workshop Report

Dear Sirs:

We are pleased to submit our final Waste Allocation Workshop Report for the Ontario Waste Management Corporation Environmental Assessment project. Comments received from workshop attendees on the previous drafts of this report have been incorporated. The report provides both a summary of the workshop proceedings carried out in January and September, 1988 and a critical analysis of the approach used.

This report goes further than previous drafts documenting the development of the regional distribution of the waste allocation quantities and the generation of new (November 1988) waste profiles based on these quantities.

The conclusions of this report are used as an input to the "alternative undertakings" analysis in the OWMC Environmental Assessment.

If you have any questions regarding this report, please call.

Yours truly,

M.M. DILLON LIMITED

Claudio Covelli, for

/rp

James R. Balfour, P.Eng.,MCIP
Project Manager

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WASTE ALLOCATION WORKSHOP

1. INTRODUCTION

The issue of waste allocation was the subject of a workshop which took place on January 18 through 20, 1988 at the Guild Inn in Scarborough. The workshop was organized by and for the Ontario Waste Management Corporation (a list of attendees is provided in Section 2). A follow-up session to the workshop was held on September 16, 1988 at the Toronto office of M.M. Dillon Limited. This meeting, which was attended by nine of the original workshop participants, was called to supplement the allocation exercise due to the availability of updated waste quantities since the first workshop.

Through an exhaustive review of Ontario Ministry of the Environment (MOE) manifest and generator registration data, VHB Research and Consulting Inc. had previously identified wastes that were "potentially seeking off-site treatment and disposal" (see Table 1 and 2). This analysis identified total waste quantities broken down by source that could require off-site treatment and disposal under different regulatory scenarios (ranging from existing to enhanced) for 1992 and 1997 as described in Volume I of OWMC's Draft Environmental Assessment.

The purpose of the workshop was to "manipulate" these data into a "useful" form for the "alternatives to" evaluation included in the

TABLE 1

Wastes Potentially Seeking Off-Site Treatment and Disposal - 1992

WASTE - CURRENT DESTINATION	ESTIMATED 1986 QUANTITIES (t)	QUANTITIES POTENTIALLY SEEKING OFF-SITE TREATMENT AND DISPOSAL** (t/annum)	
		Current Regulation	Enhanced Regulation
a) Waste Currently Handled On-Site			
On-site	Unknown	No	No
On-site treatment	1 306 000	No	No
On-site landfill	114 000	No	109 000
Dust suppression and sludge farming	35 000	No	No
Sanitary sewer	1 045 000	*	*
Sub-Total		0	109 000
b) Wastes Currently Handled Off-site			
Dust suppression	75 000	1 000	66 000
Water pollution control plants	293 000	328 000	328 000
Intermediate treatment			
- Off-site recycle	133 000	161 000	161 000
- Miscellaneous	18 000	22 000	22 000
Final treatment and disposal			
- Incinerators	50 000	59 000	59 000
- Commercial landfill	74 000	90 000	90 000
- Private landfill	49 000	58 000	58 000
- Municipal landfill	8 000	10 000	10 000
Out-of-province (Export)	42 000	51 000	51 000
Sub-Total		780 000	845 000
c) Other - Wastes Currently Not Undergoing Treatment and Disposal			
Annual Quantities			
MISA (when implemented)	N/A	34 500- 47 100	34 500- 47 100
Household	86 000	500- 5 000	500- 5 000
Site cleanup wastes	34 000	20 700- 39 100	20 700- 39 100
Site decommissioning wastes	6 900	4 200- 7 900	4 200- 7 900
Accumulated Quantities			
PCBs in Storage (high level)	1 600	580	580
PCBs in use (high level)	7 800	400	400
PCBs in Storage and in use (Low Level)	22 900	2 850	2 850
Sub-Total		64 000-103 000	64 000-103 000
TOTAL		844 000-883 000	1 018 000-1 057 000

* Residuals from improved treatment of some of these streams are included in MISA estimated.
** Totals may not sum exactly, due to rounding.

TABLE 2

Wastes Potentially Seeking Off-Site Treatment and Disposal - 1997

WASTE - CURRENT DESTINATION	ESTIMATED 1986 QUANTITIES (t)	QUANTITIES POTENTIALLY SEEKING OFF-SITE TREATMENT AND DISPOSAL** (t/annum)	
		Current Regulation	Enhanced Regulation
a) Waste Currently Handled On-Site			
On-site	Unknown	No	No
On-site treatment	1 306 000	No	No
On-site landfill	114 000	No	122 000
Dust suppression and sludge farming	35 000	No	No
Sanitary sewer	1 045 000	*	*
Sub-Total		0	122 000
b) Wastes Currently Handled Off-site			
Dust suppression	75 000	1 100	74 000
Water pollution control plants	293 000	365 000	365 000
Intermediate treatment			
- Off-site recycle	133 000	181 000	181 000
- Miscellaneous	18 000	25 000	25 000
Final treatment and disposal			
- Incinerators	50 000	65 000	65 000
- Commercial landfill	74 000	101 000	101 000
- Private landfill	49 000	64 000	64 000
- Municipal landfill	8 000	11 000	11 000
Out-of-province (Export)	42 000	56 000	56 000
Sub-Total		869 000	942 000
c) Other - Wastes Currently Not Undergoing Treatment and Disposal			
Annual Quantities			
MISA (when implemented)	N/A	36 700- 50 100	36 700- 50 100
Household	86 000	500- 5 000	500- 5 000
Site cleanup wastes	34 000	20 700- 39 100	20 700- 39 100
Site decommissioning wastes	6 900	4 200- 7 900	4 200- 7 900
Accumulated Quantities			
PCBs in Storage (high level)	1 600	0	0
PCBs in use (high level)	7 800	500	800
PCBs in Storage and in use (low level)	22 900	0	0
Sub-Total		63 000-103 000	63 000-103 000
TOTAL		932 000-972 000	1 127 000-1 167 000

* Residuals from improved treatment of some of these streams are included in MISA estimated.
** Totals may not sum exactly, due to rounding.

Environmental Assessment report. The "alternatives to" analysis involves basically two steps. First, a preferred allocation of the wastes potentially seeking off-site treatment and disposal to alternative destinations is determined. Second, OWMC's role in the achievement of that allocation is defined. The second step, thus, attempts to "fill in" any capacity or service deficiencies so as to bridge the gap between the existing and preferred systems. This workshop was carried out to assist in the first step.

In considering what is the best or preferred allocation of waste to alternative destinations, clearly an infinite number of options exist. To make the analysis manageable, a first simplifying step was to categorize alternative destinations into five groups (see Section 3 for a definition of each). Each group contains both existing and possible future destinations. Later analyses will examine what the specific future destinations should be.

The second simplifying step recognizes the realities of the waste management market place where private decisions control the actual allocation of waste. Rather than considering all combinations of different percentage allocations, different ranges of allocations are considered based on different market conditions. The base case is an allocation based on current private decisions assuming no capacity constraints exist for any practice. Alternative allocations are then defined based on two levels of intervention: i) control capacities of alternative practices (ensure or restrict provision); and ii) regulate alternative practices (promote or disallow). Since the allocations are based on different forms of intervention in the market place, they represent alternative provincial waste management strategies. Thus, the first step of the "alternatives to" analysis evaluates these different strategies.

To facilitate the evaluation of strategies, the workshop derived an allocation of waste for the "base case" (the existing market place). The definition of alternative strategies would later indicate the level of

diversion of waste between practices in relation to the base case allocation. To highlight the uncertainty associated with both the allocation exercise and the waste quantity data, the workshop attempted to identify ranges of allocations to each practice.

The allocation exercise was conducted at a fine level of detail, examining each waste stream by UCD class. The resultant range of waste quantity estimates was expected to be a good assessment of the types and amounts of wastes that might seek treatment and disposal at an OWMC facility. These quantities were used for other analyses, such as transportation-related analysis and waste profile generation. In order to facilitate these types of analyses, the allocation quantities needed to be manipulated into the format or context required. The last two sections of this report are devoted to discussions in this respect. In particular, Section 7 presents how the allocation quantities were regionally disaggregated and Section 8 discusses how these quantities were used for developing new waste profiles.

2. WORKSHOP PARTICIPANTS

The waste allocation workshop was attended by 22 participants from consulting firms, OWMC and the Ministry of the Environment. Since judgement played a significant role in the workshop process, the relevant experience of each participant is presented below:

J.E. HANNA, VHB RESEARCH AND CONSULTING

Ed Hanna, an Environmental Scientist and Principal of VHB Research and Consulting Inc., has been the individual primarily responsible for developing the Market Assessment Model for OWMC. In addition, he has worked in cooperation with Terry Burrell in developing estimates of subject waste potentially seeking off-site treatment. His consulting experience over the last 15 years includes many studies related to waste management and environmental assessment.

Ed oversaw the compilation of the background information package and model output provided to workshop attendees. In addition, he served as workshop chairman.

T. BURRELL, VHB RESEARCH AND CONSULTING

Terry Burrell, an Economist and Principal of VHB Research and Consulting Inc., has worked as a consultant for the Marketing Department of OWMC for several years and has been responsible for waste quantities estimates in the Corporation's Environmental Assessment. He has been a Consultant in waste management and environmental and energy issues for over 15 years.

Terry's role at the workshop was to provide clarification and interpretation of the estimates, which had been prepared under his direction, of wastes potentially seeking off-site treatment.

CRAIG DUNBAR, S.M. - M.M. DILLON LIMITED

Mr. Dunbar is a Project Planner with degrees in Civil Engineering (University of Toronto, 1984) and Technology and Policy (Massachusetts Institute of Technology, 1986). His experiences include waste management master plans and policy studies with a specialization in project evaluation. His role in the OWMC Environmental Assessment project included the development of the Alternative Undertakings analysis. He acted as secretary at the workshop and prepared much of this Workshop Report.

WILLIAM I. WALKER, P.ENG. - M.M. DILLON LIMITED

Mr. Walker has extensive experience in the design of waste treatment systems for industry. He participated in the design of Stablex facility in Holly, Michigan. His role in the OWMC Environmental Assessment project included

the development of waste slates and process designs to meet these waste slates. Also, he produced the Technical Buffer Zone Report based on the use of early waste profiles. As a result of significant experiences with projects in the refinery industry, he is a specialist in disposal methods for organic wastes.

MARIA KELLEHER, M.ENG. P.ENG., CANVIRO CONSULTANTS

Ms. Kelleher received her B.E. (Civil) at University College Cork in 1975. She worked for a number of years with civil and environmental consultants and received her Masters Degree in environmental engineering from the University of Toronto in 1982. She joined Canviro in 1986 and is Project Manager on a number of waste management and water resources projects. Prior to joining Canviro, Ms. Kelleher worked with MacLaren Engineers of Toronto for a number of years, and was involved in a number of pollution control projects. Her particular areas of specialization include wastewater treatment and solid waste management.

WILLIAM H. STIEBEL, MONENCO

Mr. Stiebel is the Manager of Monenco Environmental Division for the Ontario Region. He has 12 years of Canadian and overseas experience in project management, coordination and supervision of environmental and waste management projects. Many projects have been of an inter-disciplinary nature, involving pollution control and clean-up, water resource management, environmental auditing and assessment, industrial site decommissioning and clean-up and waste management.

Mr. Stiebel has directed environmental investigations associated with industrial site decommissioning and clean-up; chemical spills from underground storage tanks; environmental impact assessment of hydro-electric and coal field developments, as well as the preparation of technical and cost/benefit evaluations of various remediation programs. In addition, Mr. Stiebel has specialized expertise in the areas of aquifer analysis and contaminant transport evaluation; drainage and dewatering studies for the mining industry and water resource management for irrigation and municipal water supplies.

GEOFFREY WESTERBY, P.ENG. - GARTNER LEE ASSOCIATES LIMITED

Mr. Westerby has a B.Sc. degree in Engineering Geology from Queen's University (1971) and an M.Eng.Sc. degree in Civil Engineering and Hydrogeology from the University of New South Wales (1974). He is currently a senior hydrogeologist with Gartner Lee Limited. He has over 16 years experience in Canada and abroad providing expertise in environmental impact assessment, contaminant hydrogeology, water supply, waste management, site selection and site investigation, and the decommissioning and cleanup of industrial plants and waste disposal sites.

Mr. Westerby is also General Manager of Environmental Strategies Limited, a Gartner Lee company specializing in environmental auditing, and the development and implementation of remedial action plans. He has served as project manager or technical advisor for site investigations and the subsequent development and implementation of plant decommissioning or site cleanup plans at numerous industrial plants, waste disposal sites, and at sites of accidental spills or leaks.

DR. ROBERT G.W. LAUGHLIN, P.ENG. - ORTECH, INTERNATIONAL

Dr. Bob Laughlin grew up and was educated in the United Kingdom. He earned both his B.Sc. (Eng.) and Ph.D. degrees in Chemical Engineering from University College London. He emigrated to Canada in 1967 and joined Ontario Research Foundation. He is currently Manager of the Biotechnology and Chemical Engineering Centre. For over 15 years he has been involved in industrial waste utilization and minimization and in the treatment and control of industrial and municipal wastes. Bob is manager of the Canadian Waste Materials Exchange. He is a registered Professional Engineer in the Province of Ontario and he has recently been appointed by the Minister of the Environment, as chairman of the Hazardous Waste Listing/Delisting Advisory Committee.

R. PHILIP CANNING, P.ENG. - ZENON ENVIRONMENTAL INC.

Mr. Canning is the manager of process engineering with a degree in Chemical Engineering (Univeristy of Western Ontario, 1973). He has experiences in the management of water and waste water treatment projects, the planning and supervision of water and waste water quality assessments, the design of industrial waste water treatment systems, the training of waste water treatment plant operators and liaison work in the development of regulations. In addition, he has been involved in the planning and supervision of laboratory and pilot plant treatability studies. He has been responsible for process design and design coordination for OWMC's physical chemical treatment plant.

DR. EARL SHANON, PH.D. - CANVIRO CONSULTANTS

Dr. Shannon has Masters' and Ph.D. Degrees in Environmental Engineering and over 24 years of experience in the environmental field. He has been involved in waste water characterization, treatability investigations and process and detailed designs for industries in chemical manufacturing, metal finishing, food processing, petroleum and other industrial sectors.

He has held positions with the waste water Technology Centre of Environment Canada and with a large environmental consulting firm in the U.S. He has been with Canviro Consultants for 10 years and is currently manager of their Waterloo office. He is also president of Canviro Analytical Laboratories Limited, a full services environmental laboratory based in Kitchener. He previously (1986-87) served as president and technical director of Environsite Inc., a mobile waste management company servicing Ontario industries.

Dr. Shannon served as project director for three surveys carried out for OWMC during 1983-86, which involved collection and analysis of quantities and characteristic data for liquid and special wastes generated by 1,200 Ontario industries.

J.G. MICAK, OWMC

Mr. Micak is the Manager of Environmental Projects with OWMC. He manages all environmental planning and approvals activities for OWMC and is therefore responsible for the completion of OWMC's EA. His role at the workshop was to provide input regarding OWMC corporate policies and to ensure the consistency of the Waste Allocations Workshop proceedings with other EA activities for EA finalization.

M.L. JOHNSON - OWMC

Ms. Johnson is the supervisor of hearings for OWMC. She is responsible for OWMC's successful preparation and attendance at Environmental Assessment Board hearings. This includes coordination of activities to complete OWMC's EA documentation. Her attendance at the Waste Allocations Workshop was to ensure proceedings were compatible with Environmental Assessment Act requirements and with ongoing activities for the completion of other EA volumes.

BILL LIGHTOWLERS - OWMC

Mr. Lightowlers joined the Ontario Waste Management Corporation in February 1983, after seven years with Cara Operations Limited, the second largest food service company in Canada. Bill had served as vice president of Development and Marketing with Cara and is now Director of Marketing and Sales with OWMC.

Mr. Lightowlers' experience also includes an eight year career in the organic specialty chemical field with Diamond Shamrock and a three year assignment in environmental consulting with Beak in Toronto and Vancouver.

His education background includes a degree in chemistry and a Master's Degree in Business Administration, both from McMaster University. He is active in environmental and community issues, currently serving on the Secretariat of the National Task Force on Environment and Economy and on the Board of Governors of the Toronto YMCA.

During the development of OWMC, Mr. Lightowlers' main responsibilities relate to ensuring OWMC's facility and operating proposals will serve the needs of the generators of hazardous waste in Ontario. Bill's department also operates a Waste Reduction Program and a Laboratory to gain information on waste management and to help generators with solutions to their problems. When OWMC is operational, he will direct the marketing and sales effort required to get wastes to OWMC's facilities for treatment.

A.E. VEEL, M.SC. MBA - OWMC

Mr. Veel is the Manager of Marketing Services for OWMC. Prior to joining OWMC in 1984, Mr. Veel had 14 years experience with a major diversified steel producer. Major involvements were centred on environmental control, waste management, new product development, business development and industrial health and hygiene.

He has been responsible for the Market Assessment Program studies and particularly for managing related issues for OWMC's EA.

JANET L. LAIRD, PH.D. - OWMC

Ms. Laird has a Ph.D. in Inorganic Chemistry. Prior to joining the Marketing Department of OWMC in 1987, Janet had four years of industrial experience in the field of metallurgical research and development, working for both a mining company (Sherritt Gordon Mines Ltd., 1983-1985) and for a private metallurgical research and development firm (Witteck Development Inc., 1985-1987). Major projects included, amongst others, the development

of novel extractive hydrometallurgical processes for the recovery of precious and base metals from ore; and waste management studies for the mining and metallurgical industries including the subaerial deposition of metallurgical waste slurries and the development of novel processes for the recovery of toxic substances from metallurgical waste effluent.

DALE G. MINER - OWMC

Mr. Miner is a coordinator, Market Information, for OWMC, with responsibilities in the field of market analysis, particularly in the subject areas of generation and distribution of waste quantities, characterization of waste, and monitoring and assessment of the existing waste management market, and development of information systems. He previously worked at the University of Waterloo as a Research Assistant on projects on agricultural change in Ontario, and environmental change due to socio-economic development in Senegal (Africa).

His areas of expertise include quantitative methods, (environmental) systems analysis and simulation modeling, management information systems, computer programming and market research.

In addition, there were six participants from the Ministry of the Environment's Waste Management Branch. These included David Crump (Manager, Special Wastes and Information Support Section), Mel Fielding (Coordinator, Technology Transfer, Technology and Site Assessment Section), John Manuel (Supervisor, Special Waste Policy and Programs Unit, Special Wastes and Information Support Section), Allan Burger (Special Wastes and Information Support Section), Steven Radcliffe (Industrial Waste Management Unit) and

Doug Hickman (Industrial Waste Management Unit). Also Jim Balfour (Director, Environmental Sciences and Planning Division, M.M. Dillon Limited) made a presentation of the Alternative Undertakings analysis in the opening session of the Workshop.

3. DEFINITION OF ALTERNATIVE PRACTICES

For the purpose of the "Alternatives to" analyses, specific waste management practices were grouped into five broad categories that reflect distinct and unique options. This categorization is as follows:

- export out-of-province;
- indefinite storage;
- 4Rs (reduction, re-use, recycling and recovery);
- on-site treatment and disposal; and
- off-site treatment and disposal.

Each of these groups is defined below.

3.1 EXPORT

Export is defined as the shipment of waste outside the province for further handling, which may include storage, recycling, re-use, treatment or disposal.

3.2 INDEFINITE STORAGE

The indefinite storage of waste is defined as the storage of untreated waste in a secure manner on-site or off-site pending treatment, disposal, recycling, recovery, re-use or export. An example of this is the current practice of storing PCB-containing liquids and solids until an approved method is available for their destruction in Ontario.

3.3 REDUCTION, RE-USE, RECYCLING AND RECOVERY (4Rs)

The 4Rs practice can be summarized as the reduction in either the volume or toxicity of generated waste that is subsequently treated, stored or disposed of. This practice is carried out both on-site and off-site. On-site practices include reduction, re-use, recycling and recovery. Source reduction is defined as any activity or treatment that reduces or eliminates the generation of liquid industrial and special wastes before they are produced within a process (either through process modification or housekeeping practices). Re-use refers to activities involving the direct use of wastes and/or effluents without further processing. Recycling refers to processes which are aimed at the recovery of materials used or produced by processes for separate use or direct use in-house. Recovery refers to waste reprocessing steps which are aimed at recovering components which can be used as feed-stocks for making other products. Off-site 4Rs practices include reclaiming (recover and re-use) and waste exchange.

3.4 ON-SITE TREATMENT AND DISPOSAL

On-site treatment refers to the "end-of-pipe" treatment of wastes to reduce their volume or level of contaminant concentration prior to discharge or disposal (either on-site or off-site). Various treatment technologies are listed in Table 3. Other treatment alternatives involve the sequencing of these technologies. On-site disposal refers to the use of "permanent" disposal methods on the property of the waste generator and includes options such as landfill, land farming or discharge to a sanitary sewer. These can be applied to both treated and untreated wastes.

3.5 OFF-SITE TREATMENT AND DISPOSAL

Off-site treatment includes those practices that reduce waste volumes or levels of contaminant concentration in wastes at a facility independent of the waste generator. This includes presently used facilities such as incinerators and water pollution control plants. Off-site disposal refers to the use of "permanent" disposal methods operated independently of the generator providing wastes. This includes presently used methods such as landfilling, dust suppression and private landfilling/sludge farming.

TABLE 3

On-Site Treatment Technologies

1. Wet air oxidation
2. Liquid injection incineration (no gas treatment)
3. Liquid injection incineration (with gas treatment)
4. Rotary kiln incineration (with gas treatment)
5. Rotary kiln incineration (dilute waste/no heat recovery)
6. Distillation
7. Sludge farming
8. Boiler fuel
9. Neutralization
10. Neutralization/precipitation/ sedimentation
11. Neutralization/precipitation/ sedimentation/filtration
12. Coagulation/sedimentation
13. Coagulation/sedimentation/ filtration
14. Sedimentation
15. Filtration
16. Precipitation/filtration
17. Centrifugation
18. Evaporation
19. Biological treatment
20. Activated carbon adsorption
21. Chemical oxidation
22. Chemical reduction
23. Dissolved air flotation
24. Ion exchange
25. Metal recovery (reverse osmosis)
26. Oil-water separation
27. Solvent extraction
28. P.A.C.T.
29. Solidification

Source: Victor and Burrell, 1985.

4. INPUTS TO THE WORKSHOP ANALYSIS

The primary inputs to the workshop were the MOE databases used to estimate the quantities potentially seeking off-site treatment and disposal as summarized in Table 1 and 2. The MOE generator registration database was used to determine the quantities of waste that are currently handled on-site. The only waste stream of interest within this group is the on-site landfill stream that is potentially seeking off-site treatment and disposal under an enhanced regulation scenario. The information provided in the generator registration database is summarized in Table 4. Basically, the total waste quantity is broken down by company, MOE waste type code, handling code and quantity of waste handled.

The MOE manifest database was used to estimate quantities of waste currently handled off-site. The information available in the database is summarized in Table 5. The total waste quantities are broken down by individual off-site hauls. For each haul of special waste, the company identifier, MOE waste code and waste quantity is provided. The summary provided in the receiver file is of most interest since the quantities are summarized in Table 1 and 2 by destination type.

The other waste quantities potentially seeking off-site treatment and disposal (waste not currently undergoing treatment and disposal) were

TABLE 4

Generator Registration - Stream Specific Information

1. Company identifier

2. MOE waste class

3. Minor waste code

   a) Hazardous characteristics (e.g. pathological, severely toxic, PCB waste)

   b) Handling code:

      - dust suppression
      - waste-derived fuel
      - storage
      - landfill
      - land farming
      - OWRA facility
      - sanitary sewer
      - incinerator
      - EPA Part V facility
      - other
      - off-site, same company
      - off-site, public facility

   c) Physical state (solid, liquid, gas)

4. Specific gravity

5. Waste quantity

6. Record date

TABLE 5

Manifest Data - Information Available

Generator File

1. Company identifier
2. Receiver region (Ontario, Canada, foreign)
3. Receiver type (e.g. private landfill, incineration)
4. MOE waste class
5. Annual number of waste shipments
6. Annual quantity of waste shipped off-site
7. Date of first shipment included in total
8. Date of last shipment included in total

Receiver File

1. Company identifier
2. Region from which shipment originated (Ontario, Canada, foreign)
3. Four digit SIC of generator
4. MOE waste class
5. Annual number of waste shipments from generator
6. Annual waste quantity shipped
7. Date of first shipment included in total
8. Date of last shipment included in total

estimated based on independent consultant studies. The studies either extrapolated past Ontario experience (household, site clean-up, site decommissioning and PCB wastes) or applied other jurisdictional experience to the Ontario setting (U.S. experience related to MISA residuals). The level of data disaggregation possible is obviously not as great for these data. However, in all cases, the data were summarized by either OWMC or MOE waste classes.

The only other input to the waste allocation workshop was the market assessment computer model developed by VHB Research and Consulting Inc. This model, described in detail in Appendix A, simulated generator waste management decisions by examining individual waste flows and choosing destinations for each so as to minimize costs. Since the model required individual waste flow data for each source of waste, its applicability was limited. The treatment of the model results in those cases by the workshop participants is discussed in subsequent sections.

5. APPROACH

As indicated previously, the purpose of the workshop was to derive an allocation of waste to different destinations given the current private market place environment identifying the ranges of uncertainty associated with that allocation. A general assumption was that no capacity constraints exist for any generic destination. That is, existing practices can be expanded to meet demands. It was not assumed, however, that new specific practices could be developed.

The approach used was to examine the waste potentially seeking off-site treatment and disposal on a source by source basis (e.g. MISA wastes). Since varying levels of detail exist for the different sources of waste, allocation judgements were made differently for each. Common methodological aspects for each source are presented in this section. Unique elements for each source are discussed in Section 6. The overall allocation of wastes potentially seeking off-site treatment and disposal was determined by aggregating the allocations of individual sources of waste.

The allocation of waste to export was not considered in the workshop analysis for two reasons. First, export can be considered to be a specific destination within the off-site 4Rs and off-site treatment and disposal categories. The analysis did not attempt to determine what the internal

allocation between specific practices within each generic destination. Second, the "alternatives to" analysis was based on an evaluation of alternative strategies, as discussed previously. This approach would consider the uncertainty associated with the export alternative in developing the internal allocations for each strategy.

The allocation of waste to storage was also generally not examined at the workshop. It was agreed that under current market and regulatory conditions, the allocation to storage would be extremely limited. Therefore, the discussion of storage was limited to consideration when it was likely to be practiced due to limited alternatives (i.e. PCB waste generated through the site cleanup or decommissioning activities). Where considered, the allocation to storage was only based on what the participants judged to be likely. Since the alternatives are limited, the range of uncertainty in such cases was considered to be small.

The workshop exercise focused on the allocation of wastes potentially seeking off-site treatment and disposal between the 4Rs, on-site treatment and disposal and off-site treatment and disposal. As noted above, this was done on a source by source basis. Within each source, the participants made judgements by examining the constituent waste types separately. For each waste type, the participants attempted to clearly characterize the waste generated. Based on the type and quantity of waste examined, the participants then identified specific 4Rs, on-site treatment and disposal and off-site treatment and disposal alternatives. Where available and relevant (i.e. if participants felt that the disaggregation by waste type was not sufficient to make allocation decisions), the quantity by waste type was broken down into individual waste flows. In these cases, it was also possible to use the size of each waste flow, the generator type and the current destination as an input to the allocation analysis.

The approach then followed two steps for each waste type. First, the participants estimated the allocation of waste to the 4Rs. Second, they allocated the remaining waste between on-site and off-site treatment and disposal practices. The details of those steps are presented below.

- Allocation of Waste to 4Rs:

  The participants attempted to identify the "likely" and "maximum" quantities to be allocated to 4Rs. The "likely" allocation was based on a consideration of cost trade-offs between existing 4Rs opportunities and treatment and disposal alternatives recognizing limitations leading to current generator practices (e.g. lack of information, long-term contracts, facilities whose useful life has not expired, etc.). The "maximum" allocation also considered cost as a primary decision variable but, assumed acceptance of presently unproven 4Rs processes, perfect generator understanding of alternatives (i.e. remove the look of information barrier), ease of shifting practices or changing processes and enhanced incentives (by MOE, OWMC, etc.). Costs were considered in a general way assuming prices for alternatives are consistent with the current situation.

  The allocation was estimated as a percentage of the total waste generated for each waste type within each waste stream. These percentages were chosen from within a small group of alternatives (i.e. 10, 15, 25, 50, 75 and 100%). If there was disagreement between participants, the highest percentage allocation was used. This approach was used in an attempt to over rather than underestimate the allocation to 4Rs. The participants based their judgements on what technically could be reduced, recycled on-site (through process change or housekeeping measures) or sent to off-site recyclers or reclaimers at a comparable cost to current treatment and disposal alternatives. The allocation was adjusted to account for residuals that would have to be sent to other destinations (i.e. consider the net reduction due to 4Rs).

- Allocation of Remaining Wastes Between Treatment and Disposal Practices:

Since the purpose of the workshop exercise was to identify the bounds to each generic practice given current market place-based decisions, the workshop approach to allocating remaining wastes between on and off-site treatment and disposal consisted of the identification of the maximum allocation to each. The minimum allocation to one would simply result from diverting the maximum amount to the other.

The maximum allocation to off-site treatment and disposal in most cases was taken as 100% for wastes that are presently managed predominantly off-site. This general rule is tempered in some specific cases where the on-site cost is significantly less and the available practices are technically feasible (e.g. large generators that could physically house the necessary facilities).

The maximum allocation of waste to on-site treatment and disposal was based on the judgements of the workshop participants utilizing cost differences between current off-site alternatives and potential on-site technologies (i.e. currently accepted plus technologies presently in development), assuming generators have perfect knowledge of alternatives. To aid in this exercise the participants used the market assessment model, discussed previously, as a further input where possible. The model made its allocation decisions using a similar framework to the one noted above (i.e. cost tradeoffs assuming perfect information) but, used more specific cost data in comparing on-site practices selected based on UCD waste class definitions. Thus, these practices were not necessarily a complete list for each specific waste type considered. Rather than rerunning the model with a revised list of on-site options, the approach used was to consider the model output as a bechmark against which participants could judge its reasonableness

as an estimate of the maximum on-site allocation. If there was disagreement between participants, the highest allocation would be used. (If the model allocation was rejected, allocations would be estimated using the same limited percentile alternatives as in the 4Rs work.)

The obvious weakness of this approach is its reliance on judgements by the workshop participants. In particular, judgements were made considering general waste classifications (i.e. not specific wastes) based on a general sense of cost differences (e.g. could economies of scale be exploited on-site to make those practices comparable to existing off-site facilties?).

The alternatives to this approach, however, are limited. The wastes potentially seeking off-site treatment and disposal consist of diversions of wastes from current destinations or wastes not currently captured in the MOE database. For the latter wastes, no historical data exist that could be analyzed in order to predict industry behaviour in response to changes in the market place. For wastes currently managed on-site or off- site, only one year of data was available to the workshop participants. Again, this is insufficient in order to predict the industry response to restrictions in various practices.

The market assessment model provided a reasonable quantitative analysis where applicable. The workshop approach is considered to be an enhancement of the modeling work since, at very least, unreasonable allocations are prevented. Although imperfect, the approach brings to bear judgements by professionals with significant industry-related experience.

The approach is also quite conservative in that it tends to underestimate the likely allocation of waste to off-site treatment and disposal. Of the currently managed wastes from the total of those potentially seeking off-site treatment and disposal, most are handled by off-site treatment and disposal. The reasons for this current practice are both economic and non-

economic (e.g. lack of industry information or understanding regarding alternatives). Presumably, the non-market factors (which are not possible to specify for each waste flow) will continue to promote off-site management even without current destinations being available.

Therefore, the workshop approach makes the best use of existing data, behavioural models and expert judgement in order to estimate the allocation of wastes potentially seeking off-site treatment and disposal to alternative destinations. Nonetheless, the allocation is speculative. The uncertainty associated with it is considered when applied to the "Alternatives to" evaluation.

6. OTHER RELEVANT ISSUES

Other basic issues related to the allocation exercise and approach were raised and discussed in the preliminary session. Three were judged to be particularly relevant and are presented here. First, it was noted that this exercise and approach are completely distinct from the MOE Task Force 1 (MOE, 1987) waste quantities study. That analysis examined the allocation between specific destinations (e.g. Tricil versus OWMC) whereas this analysis only determined the allocation to different practices. Therefore, the MOE analysis estimated the quantity of waste to be handled by OWMC. This allocation was not undertaken in this workshop analysis.

The second issue was the concern that the approach was biased against 4Rs since many on-site 4Rs practices were categorized as on-site treatment and disposal. However, the total allocation to 4Rs and on-site treatment and disposal is probably fairly accurate and reflects all such practices (i.e. on-site treatment and disposal is overstated). Thus, the approach does not overestimate the off-site treatment and disposal allocation.

During and subsequent to the workshop, concerns have been expressed over the cross-classification of waste types, (i.e. the mapping between OWMC classes, MOE classes and UCD classes). The discrepanies arise from the different context or schemes under which the wastes are currently classified by different institutes. The uncertainty and variability of the wastes that will seek treatment from OWMC facilities has further complicated this issue. Therefore, the mapping has been continually revised as evidences emerged to suggest better correspondence. A list of the current mapping is attached in Appendix A. Attention is drawn to the few modification made since publication of the EA documents.

7. ALLOCATION OF INDIVIDUAL STREAMS

7.1 INTRODUCTION

To determine the potential demand for new or additional off-site treatment and disposal capacity the waste from each current destination, identified in Tables 1 and 2, are evaluated to assess the potential for contributing to this demand. As a first step in the allocation process workshop participants identified those waste volumes likely to be met by existing facilities and deducted them from the total potential off-site treatment and disposal quantities (Tables 1 and 2). The remaining volumes were allocated on the basis of individual streams. The rationale for allocating which volumes could be accommodated by existing facilities are detailed under the appropriate destination in this chapter with the following exceptions.

It was postulated that waste currently going to incineration, off-site recycle, and miscellaneous treatment destinations, will continue to go off-site to these destinations. The rational being that these are acceptable treatment facilities that will continue to process waste in the future and whose capacity need not be replaced.

For other destinations a portion of what they currently receive may not be permitted to be disposed of untreated under enhanced regulations. Wastes currently going to private landfills, public landfills, on-site landfills, off-site dust suppression and to water pollution control plants, will continue to be handled at these destinations unless specifically prohibited by committed or proposed enhanced regulations.

For most streams, the 1986 estimate was factored to derive the 1992 and 1997 estimates by applying the economic growth rates described in Section 5.2.2 of the Environmental Assessment report, on an SIC[1] basis.

7.2 WASTE EXPORT STREAM

A basic issue was raised regarding which constituents of the waste presently being exported should be considered. Originally, it was posited that only wastes now going to treatment and disposal destinations in the United States should be considered. This was based on the premise that export to other provinces would not likely be banned. Also, export to U.S. reclaimers/ recyclers was considered to be environmentally desirable and, therefore, that portion of the export quantity would not be banned.

The alternate view was that all export streams should be considered. This was based on the argument that "closing of the borders" is more likely to be a result of a political decision (i.e., provinces/states will need facilities within their borders to deal solely with their problem) than banning of certain practices. It was eventually decided that the latter view would be used in this analysis.

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[1] Standard Industrial Classification

The two primary sources of data for the export allocation exercise were the 1986 manifest data (showing waste flow quantities by actual receiver and MOE waste class) and the market assessment model output (showing waste flow quantities by receiver and UCD waste class). The model output was based on the 1986 manifest quantities assuming all export destinations were not allowed.

The export allocation exercise considered solely the 4Rs, on-site and off-site treatment and disposal options. Storage was not considered since other practices are currently available for these wastes (i.e., they are going to some treatment, recycling or reclaiming process now, out of the province). Therefore, no allocation to storage is expected based on current MOE policy.

The sequence of analysis was i) the definition of likely and maximum allocations to 4Rs, and ii) the identification of the on-site and off-site split for the remaining waste. The approach used was to determine first the allocation of waste for large waste streams as defined by the manifest records (e.g., each MOE waste class which, individually, have quantities greater than 1 000 tonnes). The likely allocation of waste to 4Rs was based primarily on the percentage of waste currently going to recyclers/ reclaimers outside of Ontario (i.e. allocation did not consider on-site 4Rs alternatives). The maximum waste allocation to 4Rs was developed through judgement based on the knowledge of processes available for general types of wastes as characterized by the MOE scheme. The allocation was given as a percentage of the total quantities. Choices were limited to percentages in increments of 25 except in cases where "fine" divisions were judged possible. Judgements were rounded up in all cases so as to be conservative (i.e., minimize the allocation to treatment and disposal). The likely and maximum allocation to 4Rs for waste classes with less than 1 000 tonnes were taken as the percentage presently going to out-of-province reclaimers/ recyclers as indicated in the manifest records.

The allocation of the remaining waste between on- and off-site treatment and disposal options involved the determination of the "bounds" on both practices. Since all of the waste is currently being hauled off-site, it was judged that 100% of all waste types would go to off-site treatment and disposal and 0% to on-site treatment and disposal. The results of the 4Rs and on-site/off-site analysis are presented in Table 6.

In order to understand how this table was generated, consider UCD Waste Class 111 (the first row). The 1986 manifest quantity of this waste was 1 112 tonnes. Applying a 2.4% per year growth factor (see the discussion of growth in Section 7.13), the 1992 quantity of interest is 1 282 tonnes ($1\ 112 \times (1.024)^6$). Since none of this waste is currently hauled to out-of-province recyclers, a 0% likely allocation to 4Rs was selected. The participants felt there was some 4Rs potential and therefore 25% was selected as the maximum allocation (to be conservatively high). The seventh and eighth entry in the table multiply the above percentages and 1 282 tonnes to determine the quantity allocated to 4Rs. To determine the on-site maximum allocation, the likely 4Rs allocation is deducted from 1 282 tonnes and the remainder (1 282 - 0 = 1 282) is multiplied by the likely 4Rs percentage. The on-site minimum quantity was determined by deducting the maximum 4Rs quantity from 1 282 tonnes and multiply the remainder (1 282 - 321 = 962[1]) by the minimum on-site percentage. This percentage is determined as the difference between 100% and the off-site maximum allocation. In this case, the maximum and minimum on-site allocations are both 0 tonnes. The maximum allocation of off-site treatment and disposal is determined by multiplying the maximum off-site percentage and the difference between the 1 282 tonnes and the likely 4Rs allocation (i.e. 100% x (1 282-0) = 1 282 tonnes). The off-site minimum quantity was determined by deducting the maximum 4Rs allocation from 1 282 tonnes and multiplying the remainder (962 tonnes) by the minimum off-site percentage. This percentage is determined as the difference between 100% and the maximum on-site percentage. In this case, the minimum off-site percentage is 100% and the minimum off-site quantity is 962 tonnes (962 x 100%).

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[1] Difference due to rounding.

TABLE 6

Allocation of Export Wastes - 1992[6]

WASTE CLASS		1986 QUANTITY	1992[1] QUANTITY	4Rs % OF 1992 QUANTITY		4Rs 1992 QUANTITY (T)		TREATMENT AND DISPOSAL % OF REMAINDER FROM 4Rs		TREATMENT AND DISPOSAL 1992 QUANTITY (T)			
UCD	NOE	(T)	(T)	LIKELY	MAX	LIKELY	MAX[2]	ON-SITE MAX	OFF-SITE MAX	ON-SITE MAX[2]	ON-SITE MIN[3]	OFF-SITE MAX[4]	OFF-SITE MIN[5]
111	112	1 112	1 282	0	25	0	321	0	100	0	0	1 282	962
112	113	4 160	4 796	50	75	2 398	3 597	0	100	0	0	2 398	1 199
113	114	304	350	100	100	350	350	0	100	0	0	0	0
121	121	1 284	1 489	0	0	0	0	0	100	0	0	1 480	1 480
122	122	551	635	75	75	476	476	0	100	0	0	159	159
123	123	592	683	0	0	0	0	0	100	0	0	683	683
133	111	4 994	5 758	100	100	5 758	5 758	0	100	0	0	0	0
141	131	683	787	0	0	0	0	0	100	0	0	787	787
151	146	959	1 106	75	75	829	829	0	100	0	0	276	276
152	148	4 316	4 976	0	25	0	1 244	0	100	0	0	4 976	3 732
167	150	83	96	0	0	0	0	0	100	0	0	96	96
211	241	1 191	1 373	0	50	0	687	0	100	0	0	1 373	687
214	211	2 127	2 452	0	25	0	613	0	100	0	0	2 452	1 839
214	212	989	1 140	75	75	855	855	0	100	0	0	285	285
214	213	2 639	3 031	75	75	2 273	2 273	0	100	0	0	758	758
223	267	220	254	0	0	0	0	0	100	0	0	254	254
224	268	232	267	0	0	0	0	0	100	0	0	267	267
225	282	684	789	75	75	591	591	0	100	0	0	197	197
227	281	552	636	25	25	159	159	0	100	0	0	477	477
243	243	60	69	0	0	0	0	0	100	0	0	69	69
244	264	571	658	0	0	0	0	0	100	0	0	658	658
245	263	835	963	50	50	481	481	0	100	0	0	481	481
254	261	40	46	0	0	0	0	0	100	0	0	46	46
254	265	110	127	0	0	0	0	0	100	0	0	127	127
258	222	114	131	10	10	13	13	0	100	0	0	118	118
261	232	66	76	0	0	0	0	0	100	0	0	76	76
262	231	101	116	0	0	0	0	0	100	0	0	116	116
263	233	22	25	100	100	25	25	0	100	0	0	0	0
281	221	14	16	75	75	12	12	0	100	0	0	4	4
281	252	3 051	3 518	75	75	2 638	2 638	0	100	0	0	879	879
282	251	1 180	1 360	25	25	340	340	0	100	0	0	1 020	1 020
284	254	3 261	3 760	50	50	1 880	1 880	0	100	0	0	1 880	1 880
284	253	1 171	1 350	100	100	1 350	1 350	0	100	0	0	0	0
225	262	454	523	100	100	523	523	0	100	0	0	0	0
431	142	5	6	100	100	6	6	0	100	0	0	0	0
523	270	1 022	1 178	0	0	0	0	0	100	0	0	1 178	1 178
454	145	1 836	2 117	75	75	1 588	1 588	0	100	0	0	529	529
509	331	20	23	0	0	0	0	0	100	0	0	23	23
528	312	2 347	2 706	0	0	0	0	0	100	0	0	2 706	2 706
TOTAL		43 942	50 662			22 548	26 611			0	0	28 114	24 051

Notes:

[1] Export quantity is assumed to grow 2.4% annually since 1986.
[2] 1992 Quantity x (100% - 4Rs likely %) x (On-site max treatment %)
[3] 1992 Quantity x (100% - 4Rs max %) x (100% - Off-site max treatment %)
[4] 1992 Quantity x (100% - 4Rs likely %) x (Off-site max treatment %)
[5] 1992 Quantity x (100% - 4Rs max %) x (100% - On-site max treatment %)
[6] Totals may not sum exactly due to rounding.

Each row in the table is computed in an identical fashion to above. The totals for each allocation are given at the bottom of the table and can be computed by summing each column. (Note: Only quantity columns are summed).

A design year of 1997 was also considered for the long run. Assuming the same level of waste treatment technologies in 1992, the allocation judgements made by the experts were carried over to 1997. Results of the allocation analysis are presented in Table 7.

Notice that the growth rate from 1986 to 1997 was 2.3% instead of 2.4%. The difference accounts for the non-uniform temporal growth anticipated over the different time spans. For UCD 111, the quantity of interest becomes 1 428 tonnes (1 112 x $(1.023)^{11}$). The rest of the development is identical to the method used in Table 6.

7.3 WASTES IN STORAGE

There was a general discussion of the likely fate of wastes currently going into storage (approximately 20 000 tonnes per year). It was argued that Regulation 309 would force industries to manage wastes in an alternate manner. The participants agreed that the waste would almost exclusively go to off-site treatment and disposal (presently to export and Tricil). However, it was uncertain as to whether there would be any stored wastes remaining in 1992 when OWMC proposes to open its facility. Thus, the issue was raised as to whether any of this waste is of concern to OWMC. Sixty-five firms presently sending wastes to storage were interviewed and it was concluded that only seven had legitimate reasons to continue this practice in the near future. Therefore, it was concluded that there would be practically no waste in storage by 1992. The allocation of stored waste was not pursued further.

TABLE 7

Allocation of Export Wastes - 1997

WASTE CLASS		1986	1997[1]	4Rs				TREATMENT AND DISPOSAL					
				% OF 1997 QUANTITY		1997 QUANTITY (T)		% OF REMAINDER FROM 4Rs		1997 QUANTITY (T)			
UCD	NOE	QUANTITY (T)	QUANTITY (T)	LIKELY	MAX	LIKELY	MAX	ON-SITE MAX	OFF-SITE MAX	ON-SITE MAX	ON-SITE MIN	OFF-SITE MAX	OFF-SITE MIN
111	112	1 112	1 428	0	25	0	357	0	100	0	0	1 428	1 071
112	113	4 160	5 342	50	75	2 671	4 007	0	100	0	0	2 671	1 336
113	114	304	390	100	100	390	390	0	100	0	0	0	0
121	121	1 284	1 649	0	0	0	0	0	100	0	0	1 649	1 649
122	122	551	708	75	75	531	531	0	100	0	0	177	177
123	123	592	760	0	0	0	0	0	100	0	0	760	760
133	111	4 994	6 413	100	100	6 413	6 413	0	100	0	0	0	0
141	131	683	877	0	0	0	0	0	100	0	0	877	877
151	146	959	1 232	75	75	924	924	0	100	0	0	308	308
152	148	4 316	5 543	0	25	0	1 386	0	100	0	0	5 543	4 157
167	150	83	107	0	0	0	0	0	100	0	0	107	107
211	241	1 191	1 529	0	50	0	765	0	100	0	0	1 529	765
214	211	2 127	2 731	0	25	0	683	0	100	0	0	2 731	2 049
214	212	989	1 270	75	75	953	953	0	100	0	0	318	318
214	213	2 629	3 376	75	75	2 532	2 532	0	100	0	0	844	844
223	267	220	283	0	0	0	0	0	100	0	0	283	283
224	268	232	298	0	0	0	0	0	100	0	0	298	298
225	282	684	878	75	75	659	659	0	100	0	0	220	220
227	281	552	709	25	25	177	177	0	100	0	0	532	532
243	243	60	77	0	0	0	0	0	100	0	0	77	77
244	264	571	733	0	0	0	0	0	100	0	0	733	733
245	263	835	1 072	50	50	536	536	0	100	0	0	536	536
254	261	40	51	0	0	0	0	0	100	0	0	51	51
254	265	110	141	0	0	0	0	0	100	0	0	141	141
258	222	114	146	10	10	15	15	0	100	0	0	132	132
261	232	66	85	0	0	0	0	0	100	0	0	85	85
262	231	101	130	0	0	0	0	0	100	0	0	130	130
263	233	22	28	100	100	28	28	0	100	0	0	0	0
281	221	14	18	75	75	13	13	0	100	0	0	4	4
281	252	3 051	3 918	75	75	2 939	2 939	0	100	0	0	980	980
282	251	1 180	1 515	25	25	379	379	0	100	0	0	1 137	1 137
284	254	3 261	4 188	50	50	2 094	2 094	0	100	0	0	2 094	2 094
284	253	1 171	1 504	100	100	1 504	1 504	0	100	0	0	0	0
417	262	454	583	100	100	583	583	0	100	0	0	0	0
431	142	5	6	100	100	6	6	0	100	0	0	0	0
447	270	1 022	1 312	0	0	0	0	0	100	0	0	1 312	1 312
454	145	1 836	2 358	75	75	1 768	1 768	0	100	0	0	589	589
509	331	20	26	0	0	0	0	0	100	0	0	26	26
528	312	2 347	3 014	0	0	0	0	0	100	0	0	3 014	3 014
TOTAL		43 942	56 430			25 115	29 641			0	0	31 315	26 789

Notes:

[1] Export quantity is assumed to grow 2.3% annually since 1986.
[2] 1997 Quantity x (100% - 4Rs likely %) x (On-site max treatment %)
[3] 1997 Quantity x (100% - 4Rs max %) x (100% - Off-site max treatment %)
[4] 1997 Quantity x (100% - 4Rs likely %) x (Off-site max treatment %)
[5] 1992 Quantity x (100% - 4Rs max %) x (100% - On-site max treatment %)
[6] Totals may not sum exctly due to rounding.

7.4 PCBs

The present inventory of PCBs in storage and in use was presented to the group for review. The inventory was separated into high strength (greater than 5,000 ppm) and low strength (less than 5000 ppm).

It was generally agreed that the total PCB waste inventory would not grow significantly since no industrial processes generate new PCB wastes. Nonetheless, there would likely be some marginal discovery rate which would depend on the failure rate of PCB equipment (or the rate at which such equipment is taken out of service). As a conservative assumption, the discovery rate was taken to be zero for high strength PCBs. Low strength PCBs can be treated now. Therefore, it was assumed that the discovery rate would cancel the destruction rate giving no net gains.

For high strength PCBs, there is no 4Rs potential since PCB contaminated liquids cannot legally be sold reused or recyled. On-site management is also extremely limited since it requires enormous areas and costs. Given the fact that most of the existing storage sites are quite small, economics and technical feasibility would make on-site treatment unfeasible. Thus, if an acceptable off-site facility exists, all of the high strength PCBs would be directed to it.

For low strength PCBs, no 4Rs is forseeably available. Several on-site treatment technologies are recognized. However, cost and liability concerns will limit their use, as evidenced by current practices. Nonetheless, it was agreed that a maximum of 100% low strength PCBs could be managed either on-site or off-site. The results of the above analysis are summarized in Tables 8 and 9 for the years 1992 and 1997 respectively. The method of development is identical to that in Table 6, Section 7.2. The quantities of interest were provided by M.M. Dillon Ltd. Notice that low-strength PCBs are expected to be phased out by 1997.

TABLE 8

Allocation of PCB Wastes - 1992

UCD WASTE CLASS	1992 QUANTITY (T)	4Rs				TREATMENT AND DISPOSAL					
		% OF TOTAL QUANTITY		1992 QUANTITY (T)		% OF REMAINDER FROM 4Rs		1992 QUANTITY (T)			
		LIKELY	MAX	LIKELY	MAX	ON-SITE MAX	OFF-SITE MAX	ON-SITE MAX	ON-SITE MIN	OFF-SITE MAX	OFF-SITE MIN
Current Regulations:											
242											
a)[1]	2 850	0	0	0	0	100	100	2 850	0	2 850	0
b)[2]	980	0	0	0	0	0	100	0	0	980	980
TOTAL[3]	3 830			0	0			2 850	0	3 830	980

Notes:

[1] Low level PCBs in storage and in use.
[2] High level PCBs in storage and in use.
[3] There is no additional quantity under Enhanced Regulations.

TABLE 9

Allocation of PCB Wastes - 1997

UCD WASTE CLASS	1997 QUANTITY (T)	4Rs				TREATMENT AND DISPOSAL					
		% OF TOTAL QUANTITY		1997 QUANTITY (T)		% OF REMAINDER FROM 4Rs		1997 QUANTITY (T)			
		LIKELY	MAX	LIKELY	MAX	ON-SITE MAX	OFF-SITE MAX	ON-SITE MAX	ON-SITE MIN	OFF-SITE MAX	OFF-SITE MIN
Current Regulations:											
242											
b)[1]	500	0	0	0	0	0	100	0	0	500	500
SUB-TOTAL	500			0	0			0	0	500	500
Enhanced Regulations:											
242											
b)[1]	300	0	0	0	0	0	100	0	0	300	300
SUB-TOTAL	300			0	0			0	0	300	300
TOTAL	800			0	0			0	0	800	800

Notes:

[1] High level PCBs in use.

7.5 ON-SITE LANDFILL STREAMS

The quantity of waste currently going to on-site landfill is only potentially seeking off-site treatment and disposal under a scenario of enhanced regulation. In order to attempt to quantify what waste quantity would be affected by future regulations, a study was undertaken examining enhanced regulations currently in place in the United States. In particular, the 1984 amendments to RCRA (HSWA wastes) involved the banning of the disposal of certain categories of untreated hazardous wastes in landfills.

Energy Systems Research Group (1987) examined the HSWA amendments to RCRA and attempted to identify present on-site landfill streams (as defined by MOE classification) that would likely be banned. The participants assembled agreed that this analysis was a reasonable depiction of a potential future Ontario scenario.

In order to allocate the wastes from this source, the wastes were analyzed by individual MOE class for MOE classes with greater than 1000 t of waste. The allocation to 4Rs (likely/maximum) was solely based on judgement considering the type of material examined and the type of industries producing the waste. The maximum off-site allocation of the remaining waste was considered to be 100% since off-site landfilling is currently a viable option. The maximum on-site allocation was taken from the market assessment model results. These allocations were tempered in some instances given participant knowledge with respect to specific alternatives. The model run was based on the HSWA streams not including registerable solids. Tricil was not a permitted destination in the analysis so as to conservatively underestimate the amount of waste going off-site. The maximum on-site allocation for small waste streams (less than 1000 tonnes per year) was taken directly from the model output. The likely and maximum 4Rs allocations for small waste streams were taken as the weighted average of the allocations to larger streams.

Specific arguments for the allocation of specific waste streams are presented below:

- MOE 146: (other specified inorganics)

  A general discussion ensued as to what specific waste is included in this class. It was agreed that this was likely to be partly foundry sands. An MOE study of the reuse of foundry sands for backfill was mentioned indicating a maximum or likely 4Rs component. However, it was agreed that if the materials were leachate toxic, their use as backfill would not be allowed.

  Due to the specific nature of this waste (most are residuals after recycling or are highly concentrated), it was concluded that there was no potential for 4Rs. On-site practices were considered of limited potential due, in many instances, to space limitations. Also, it was felt that off-site allocation would be more likely due to site cleanup liability concerns. The model allocation of 10% to on-site was, therefore, considered to be a reasonable maximum.

- MOE 111: (spent pickle liquor)

  The participants felt that there were limited technical opportunities for 4Rs management of this waste. Since the individual streams are relatively small, the costs of these would be prohibitive as compared to other treatment and disposal alternatives. Thus, the likely allocation to 4Rs was taken as zero with an upper limit of 25%. The model allocation of 40% on-site management was taken as a reasonable maximum reflecting small stream sizes (economies of scale favours off-site management).

- MOE 122: (alkaline waste - other metals)

  This waste stream is alkali containing metals which comes primarily from large industries with advanced on-site capabilities and is currently being sent to final treatment despite existing 4Rs alternatives. Thus, the likely allocation to 4Rs was taken to be negligible with an upper limit of 25%. The on-site allocation was taken from the model as a reasonable maximum.

- MOE 251: (oil skimmings and sludges)

  Since this waste contains oil, it was felt that there exists some potential for recovery. However, given present less costly treatment alternatives, the likely allocation to 4Rs was zero. The on-site allocation was taken from the model as a reasonable maximum but it was noted that residuals from a recovery process would require off-site management.

- MOE 270: (other specified organics)

  It was felt that there is some 4Rs potential, primarily through process changes. This waste partly contains tetraethyl lead which is in the process of being removed from gasoline. However, this was considered to be a slow process and, therefore, the likely 4Rs allocation was taken to be zero. Other organic sludges in this waste stream were judged to have no 4Rs potential. All of this waste would have to be treated off-site (limited on-site alternatives exist but economies of scale would favour off-site management).

- MOE 112: (acid waste - heavy metals)

  Given that the same technologies are possible as considered for the export stream, the allocation of waste to 4Rs was taken to be the same (no likely allocation but some potential). While it was agreed that the waste would be treated off-site if it were a sludge, the exact content of the waste was not possible to determine. Therefore, 100% on-site treatment as a maximum was conservatively assumed.

- MOE 131: (neutralized waste - heavy metals)

  Identical arguments and allocations to MOE 112 since both waste types contain heavy metals.

Based on the MOE Generator Registration database VHB Research and Consulting Inc. estimated that 114 000 tonnes were landfilled on-site in 1986. Of this, 94 700 would potentially seek off-site treatment and disposal, based on MOE waste classes assigned as "likely" under an HSWA type landfill ban. This estimate increases to 109 200 tonnes by 1992 and 122 900 by 1997. The 1986 quantity was factored by an annual growth rate of 2.4%.

The results of the allocations exercise for the on-site landfill stream are presented in Tables 10 and 11 for 1992 and 1997 respectively. The method for developing the table is identical to that used in developing Table 6 (see Section 7.2).

7.6 HOUSEHOLD WASTES

A study of the annual hazardous wastes produced by households in Ontario was presented which indicated that in the order of 86 000 tonnes per year is generated (Canviro, 1988). This includes paint wastes (17 000 tonnes),

TABLE 10

Allocation of On-site Landfill Wastes - 1992

WASTE CLASS		1986 LANDFILL QUANTITY	1992[1] LANDFILL QUANTITY	4Rs				TREATMENT AND DISPOSAL					
				% OF 1992 QUANTITY		1992 QUANTITY (T)		% OR REMAINDER FROM 4Rs		1992 QUANTITY (T)			
UCD	MOE	(T)	(T)	LIKELY	MAX	LIKELY	MAX	ON-SITE MAX	OFF-SITE MAX	ON-SITE MAX	ON-SITE MIN	OFF-SITE MAX	OFF-SITE MIN
111	112	1 444	1 665	0	25	0	416	100	100	1 665	0	1 665	0
121	121	300	346	0	25	0	86	25	100	86	0	346	195
122	122	18 060	20 822	0	25	0	5 205	100	100	20 822	0	20 822	0
133	111	16 800	19 369	0	25	0	4 842	40	100	7 748	0	19 369	8 718
141	131	1 200	1 384	0	25	0	346	100	100	1 384	0	1 384	0
151	146	44 572	51 388	0	25	0	12 847	10	100	5 139	0	51 388	34 687
211	241	2	2	0	25	0	1	35	100	1	0	2	1
214	212	9	10	0	25	0	3	35	100	4	0	10	5
214	213	8	9	0	25	0	2	35	100	3	0	9	4
244	264	13	15	0	25	0	4	35	100	5	0	15	7
281	221	96	111	0	25	0	28	35	100	39	0	111	54
282	251	6 906	7 962	0	25	0	1 991	100	100	7 962	0	7 962	0
523	270	5 280	6 087	0	25	0	1 522	0	100	0	0	6 087	4 566
TOTAL		94 690	109 170			0	27 293			44 857	0	109 170	48 235

Notes:

[1] Landfill Quantity is assumed to grow 2.4% annually since 1986.

TABLE 11

Allocation of On-site Landfill Wastes - 1997

WASTE CLASS		1986 LANDFILL QUANTITY	1997[1] LANDFILL QUANTITY	4Rs				TREATMENT AND DISPOSAL					
				% OF 1997 QUANTITY		1997 QUANTITY (T)		% OR REMAINDER FROM 4Rs		1997 QUANTITY (T)			
UCD	MOE	(T)	(T)	LIKELY	MAX	LIKELY	MAX	ON-SITE MAX	OFF-SITE MAX	ON-SITE MAX	ON-SITE MIN	OFF-SITE MAX	OFF-SITE MIN
111	112	1 444	1 874	0	25	0	469	100	100	1 874	0	1 874	0
121	121	300	389	0	25	0	97	25	100	97	0	389	219
122	122	18 060	23 443	0	25	0	5 861	100	100	23 443	0	23 443	0
133	111	16 800	21 808	0	25	0	5 452	40	100	8 723	0	21 808	9 813
141	131	1 200	1 558	0	25	0	389	100	100	1 558	0	1 558	0
151	146	44 572	57 858	0	25	0	14 464	10	100	5 786	0	57 858	39 054
211	241	2	3	0	25	0	1	35	100	1	0	3	1
214	212	9	12	0	25	0	3	35	100	4	0	12	6
214	213	8	10	0	25	0	3	35	100	4	0	10	5
244	264	13	17	0	25	0	4	35	100	6	0	17	8
281	221	96	125	0	25	0	31	35	100	44	0	125	81
282	251	6 906	8 965	0	25	0	2 241	100	100	8 965	0	8 965	0
523	270	5 280	6 854	0	25	0	1 713	0	100	0	0	6 854	5 140
TOTAL		94 690	122 915			0	30 729			50 504	0	122 915	54 308

Notes:

[1] Landfill Quantity is assumed to grow 2.4% annually since 1986.

generated (Canviro, 1988). This includes paint wastes (17,000 tonnes), spent solvents (3 000 tonnes), used oils (41 000 tonnes), antifreeze (14 000 tonnes), pesticide waste (6 000 tonnes) and other wastes (5 000 tonnes). It was noted, however, that presently approximately 50 tonnes per year is collected. A discussion ensued as to what quantity collected in the future could be expected given enhanced practices and policies. Given enhanced practices, it was agreed that in the order of 500 tonnes could be expected. A potential high of 5 000 tonnes was also agreed upon.

Neither storage nor on-site treatment was deemed likely since household wastes were collected on "Haz-waste days" in local communities, i.e. there is not a site, just a collection point". No 4Rs would be pursued because of the small quantities. The exception to this is UCD 281, waste oils. Given cost-effective recovery processes, workshop participants agreed that 75% of this waste would be subjected to 4Rs.

The allocation of household wastes is summarized in Table 12. The distribution of 5 000 t/a between UCD classes were derived from Canviro's June 1988 Report on Special Waste Generation Non-Industrial Sector in Ontario.

7.7 SITE CLEANUP AND DECOMMISSIONING

Decommissioning is defined as an activity which occurs when a plant or facility closes down, and can be identified as a necessary activity during the operating phase of the plant. The decommissioning of existing industrial sites, including oil refineries, bulk oil storage facilities and gasoline stations, is an ongoing process which will generate 100 000 tonnes per year over the next 10 years (based on an analysis of the past two years data).

TABLE 12

Allocation of Household Wastes - 1992
(High Quantity Estimate)[1]

UCD WASTE CLASS	1992[2] QUANTITY (T)	4Rs				TREATMENT AND DISPOSAL					
		% OF TOTAL QUANTITY		1992 QUANTITY (T)		% OF REMAINDER FROM 4Rs		1992 QUANTITY (T)			
		LIKELY	MAX	LIKELY	MAX	ON-SITE MAX	OFF-SITE MAX	ON-SITE MAX	ON-SITE MIN	OFF-SITE MAX	OFF-SITE MIN
262	708	0	0	0	0	0	100	0	0	708	708
211	40	0	0	0	0	0	100	0	0	40	40
212	40	0	0	0	0	0	100	0	0	40	40
213	40	0	0	0	0	0	100	0	0	40	40
214	40	0	0	0	0	0	100	0	0	40	40
215	348	0	0	0	0	0	100	0	0	348	348
216	40	0	0	0	0	0	100	0	0	40	40
217	878	0	0	0	0	0	100	0	0	878	878
281	2 520	75	75	1 890	1 890	0	100	0	0	630	630
241	260	0	0	0	0	0	100	0	0	260	260
532	86	0	0	0	0	0	100	0	0	86	86
TOTAL	5 000			1 890	1 890			0	0	3 110	3 110

Notes:

[1] The low quantity allocation of Household Waste can be determined by dividing each quantity by 10 (i.e. the total quantity is 500 t/a).

[2] 1997 quantities are the same as 1992 quantities.

Site cleanup is initiated as a result of the discovery of a specific waste problem. Cleanups include old coal tar sites (eg. Waterloo), PCB cleanups (Smithville, Pottersburg Creek) and old landfill cleanups (Pauze, Gloucester). The wastes include coal PCB contaminated soils, tar contaminated soils, coal tar residues, oil contaminated soils, toluene contaminated soils and soils with heavy metals.

Since site cleanup and decommissioning wastes are not currently treated, quantities had to be estimated. A study conducted by Canviro[1] has provided the background in this respect. Due to the uncertainties involved, ranges of quantity estimates were provided by VHB Research and Consulting Inc. The hazardous component of site cleanup and decommissioning wastes was identified as PCB contaminated soils.

During the workshop, doubts were raised as to how the waste described in Canviro's report could be more specifically identified. (The report broke down the waste by OWMC class). The approach selected was to consider wastes based on the broad definitions outlined by Canviro and consider how allocations would change if the wastes were better characterized by specific UCD classes. The analysis, by OWMC class, is presented below:

- Class 6 (UCD 431)

  These wastes were identified by Canviro to be heavy metal sludges. Although there are limited opportunities for 4Rs, some potential was assumed since the recoverable components are quite valuable. Since several treatment alternatives exist, no storage was deemed likely for this waste. The on-site treatment and disposal options are technically limited with the exception of in-situ processes if the waste is currently in a lagoon. Since most cleanup/decommissioning activities are carried out so that the property in question can eventually be sold or used for a new purpose, the lagoon treatment alternative would not

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1 Canviro Consultants, Report on Wastes Generated from Site Clean-Up and Decommissioning Activities in Ontario, May 1988.

realistically be applied. It was concluded, therefore, that none of this waste would be managed on-site and all of it would go to off-site treatment and disposal.

- Class 1 (UCDs 523 and 252)

No storage was considered likely for this waste since viable alternatives exist. For coal tar wastes, several biomediation technologies were identified for extracting materials. A discussion ensued as to whether such processes should be considered as 4Rs or on-site treatment and disposal. It was agreed to consider them as on-site treatment and disposal alternatives. Thus, 4Rs technologies are extremely limited, although some potential for reduction was considered possible. Since biomediation would be most viable for larger generators of waste, 90% on-site managment was taken as a maximum. Assuming acceptable off-site facilities, it was concluded that 100% of this could go off-site at a maximum.

A special discussion ensued for tannery wastes which was included in this class (UCD 252). It was felt that no 4Rs technologies were presently available. However, some future developments could be envisioned to recover chrome since it is quite valuable (10% maximum). Heat bleaching was identified as a possible on-site treatment technology. However, it was agreed that if it were easy and cost-effective, it would be used now. Thus a 10% maximum to on-site treatment was conservatively assumed. Given available off-site treatment and disposal, all of the waste could be managed there.

- Class 14 (UCD 512)

These site cleanup wastes were broken down into two different types of material: PCB contaminated soils and organisms contaminated soils. It

was argued, for PCB soils, that storage would be limited due to liability concerns and a desire to sell/reuse the property. However, it was felt that 10% of this waste would be stored since small generators might not have economical alternatives. No 4Rs alternatives could be identified for these wastes. It was felt that large sites could manage the wastes on-site through solvent extraction, biodegradation and other process. An estimate of 50% maximum on-site management was deemed reasonable. Given available technologies, all of the waste could be handled off-site.

The organics contaminated soils (10% organics) was expected to be primarily managed off-site pending available facilities. If facilities exist, storage would not be pursued due to a desire to eliminate the waste. As for PCB soils, no 4Rs technologies were identified. Also, the value of the recovered material, in this case, was considered to be limited. Some of the waste could be handled on-site (e.g. pressure fermentation). However, given the difficulties in handling this waste and given current trends in management (e.g. at Waterloo City Hall, all of the soil was sent off-site), on-site managment would be limited (25% was taken as a conservative high estimate of the maximum off-site allocation).

- Class 5 (UCD 286)

  These organic contaminated soils are similar to those discussed above. It was felt that more on-site technologies were available in this case and, therefore, the maximum on-site treatment and disposal allocation was increased to 50%.

The results of the above analyses are shown in Tables 13 and 14 for the high and low quantity estimates respectively. The method for developing the tables is identical to that for Table 6, Section 7.2.

TABLE 13

Allocation of Site Cleanup and Decommissioning Wastes - 1992
(High Quantity Estimates)

UCD WASTE CLASS	1992[1] QUANTITY (T)	STORAGE % OF TOTAL	STORAGE 1992 QUANTITY (T)	4Rs % OF REMAINDER AFTER STORAGE LIKELY	4Rs % OF REMAINDER AFTER STORAGE MAX	4Rs 1992 QUANTITY (T) LIKELY	4Rs 1992 QUANTITY (T) MAX	TREATMENT AND DISPOSAL % OF REMAINDER FROM 4Rs ON-SITE MAX	TREATMENT AND DISPOSAL % OF REMAINDER FROM 4Rs OFF-SITE MAX	TREATMENT AND DISPOSAL 1992 QUANTITY (T) ON-SITE MAX	TREATMENT AND DISPOSAL 1992 QUANTITY (T) ON-SITE MIN	TREATMENT AND DISPOSAL 1992 QUANTITY (T) OFF-SITE MAX	TREATMENT AND DISPOSAL 1992 QUANTITY (T) OFF-SITE MIN
431	4 460	0	0	0	10	0	446	0	100	0	0	4 460	4 014
252	2 230	0	0	0	10	0	223	10	100	223	0	2 230	1 806
523	2 230	0	0	0	10	0	223	90	100	2 007	0	2 230	201
286	4 460	0	0	0	0	0	0	50	100	2 230	0	4 460	2 230
245	2 230	0	0	0	0	0	0	25	100	558	0	2 230	1 673
512													
a)[2]	24 700	10	2 470	0	0	0	0	50	100	11 115	0	22 230	11 115
b)[3]	6 690	0	0	0	0	0	0	25	100	1 673	0	6 690	5 018
TOTAL	47 000		2 470			0	892			17 805	0	44 530	26 056

Notes:

[1] 1997 quantities are the same as 1992 quantities.
[2] PCB contaminated soils.
[3] Other spill cleanup wastes.

TABLE 14

Allocation of Site Cleanup and Decommissioning Wastes - 1992
(Low Quantity Estimate)

UCD WASTE CLASS	1992[1] QUANTITY (T)	STORAGE % OF TOTAL	STORAGE 1992 QUANTITY (T)	4Rs % OF REMAINDER AFTER STORAGE LIKELY	4Rs % OF REMAINDER AFTER STORAGE MAX	4Rs 1992 QUANTITY (T) LIKELY	4Rs 1992 QUANTITY (T) MAX	TREATMENT AND DISPOSAL % OF REMAINDER FROM 4Rs ON-SITE MAX	TREATMENT AND DISPOSAL % OF REMAINDER FROM 4Rs OFF-SITE MAX	TREATMENT AND DISPOSAL 1992 QUANTITY (T) ON-SITE MAX	TREATMENT AND DISPOSAL 1992 QUANTITY (T) ON-SITE MIN	TREATMENT AND DISPOSAL 1992 QUANTITY (T) OFF-SITE MAX	TREATMENT AND DISPOSAL 1992 QUANTITY (T) OFF-SITE MIN
431	2 380	0	0	0	10	0	238	0	100	0	0	2 380	2 142
252	1 190	0	0	0	10	0	119	10	100	119	0	1 190	964
523	1 190	0	0	0	10	0	119	90	100	1 071	0	1 190	107
286	2 380	0	0	0	0	0	0	50	100	1 190	0	2 380	1 190
245	1 190	0	0	0	0	0	0	25	100	298	0	1 190	893
512													
a)[2]	13 000	10	1 300	0	0	0	0	50	100	5 850	0	11 700	5 850
b)[3]	3 570	0	0	0	0	0	0	25	100	893	0	3 570	2 678
TOTAL	24 900		1 300			0	476			9 420	0	23 600	13 823

Notes:

[1] 1997 quantities are the same as 1992 quantities.
[2] PCB contaminated soils.
[3] Other spill cleanup wastes.

7.8 DUST SUPPRESSION

Dust suppression activities are currently carried out both at the industrial site (on-site) and at off-site destinations. As a result of legislation changes effective 1 January 1989, some of UCD 282 is no longer permissible for dust suppression. The corresponding quantity was estimated to be 950 t/a by 1992 and 1 050 t/a by 1997. For other waste streams, on-site practice is likly to continue under current regulations. Under enhanced regulations, it was judged that the MOE would not pursue regulations in the industrial setting. Therefore, all wastes currently handled through on-site dust suppression will likely continue to be disposed of in that manner.

Under enhanced regulations, similar to the HSWA ban in the United States, it was felt that off-site practices would be limited and waste generated would, therefore, seek alternate destinations. This exercise, thus, focused on the portion of waste currently going to off-site dust suppression that would likely fall under a HSWA-type ban.

The allocation approach was identical to that for the export waste stream (i.e., export and storage are not considered). The 4Rs allocation (likely and maximum) was based on workshop participant judgement considering wastes on a stream by stream basis (as broken down using the MOE classification system). The maximum off-site treatment and disposal allocation of the remaining waste is 100% (since it is currently going offsite). The maximum on-site allocation was based on the market assessment model simulation, tempered, in some circumstances, by participant judgement. Small streams (under 1 000 t/a) were not explicitly considered. The 4Rs allocation for those streams was taken as the weighted average of the other streams. In each case, the participants agreed that the maximum on-site allocations for small streams were well represented by the model output.

Specific arguments for the allocation of "large" waste streams are presented below:

- MOE 267: (organic acids)

  It was felt that the extent of recycling or recovery of this waste is likely constrained by technical limitations rather than by economics since its components are quite valuable. Therefore, although there was judged to be some future potential for 4Rs on this stream, the likely 4Rs allocation is expected to be zero. The maximum on-site allocation by the model was 100%. However, it was judged that a 50% maximum was more reasonable based on uncertain treatment technologies.

- MOE 251: (oil skimmings and sludges)

  With limited sludges mixed in this waste, it was felt that a 25% allocation to 4Rs was both likely and maximum (some opportunities for reduction). Although many participants felt that a maximum allocation of 50% to on-site treatment and disposal was reasonable, the model indicated that 100% was possible. Consequently, 100% was accepted.

- MOE 270: (other specified organics)

  The major source of this waste was a pulping operation generating black liquor. Therefore, it was felt that all of it would be managed through on-site treatment and disposal (significant technical opportunities exist and economies of scale can be exploited).

Based on the MOE manifest receiver file VHB Research and Consulting Inc. estimated that 75 000 tonnes were used for off-site dust supression in 1986. Of this, approximately 56 100 would potentially seek off-site treatment and disposal, based on MOE waste classes assigned as "likely" under an

HSWA type ban. This estimate increases to 66 200 by 1992 and 74 400 by 1997. The 1986 quantity was factored by an annual growth rate of 2.8% from 1986 to 1992 and by 2.6% from 1986 to 1997, except for UCD 282. The 1992 and 1997 estimates for UCD 282 were provided by VHB Research and Consulting Inc.

The summaries of this analysis are presented in Table 15 and 16 for 1992 and 1997 respectively. The method used to develop these tables is identical to that used for Table 6, as described in Section 7.2.

7.9 MISA WASTES

Since MISA wastes are not currently treated, quantities had to be estimated. Ranges of quantity estimates by 1992 and 1997 were developed by VHB Research and Consulting Inc. based on U.S. data for their pretreatment standard programs.

It was agreed among workshop participants that storage of MISA wastes could not be pursued since viable alternatives exist for all wastes examined. The other allocations, by UCD class, are summarized below:

- UCD 431 (heavy metal sludges)

  Given current 4Rs operations recovering the metals from similar heavy metal sludges (e.g. HEVMET in Hamilton), it was argued that significant 4Rs opportunities exist. Since small generators might not be able to afford the high start-up costs associated with these processes, an estimate of 25% was taken as the likely allocation to 4Rs. Given more favourable economics and technological development, it was felt that up to 75% of this waste could be managed through the 4Rs (this discounts the residuals requiring further treatment). With respect to treatment and disposal, the U.S. trend is towards on-site management (while the

TABLE 18

Allocation of Off-Site Dust Suppression Wastes - 1992

WASTE CLASS UCD	WASTE CLASS NOE	1986 QUANTITY (T)	1992[1] QUANTITY (T)	4Rs % OF 1992 QUANTITY LIKELY	4Rs % OF 1992 QUANTITY MAX	4Rs 1992 QUANTITY (T) LIKELY	4Rs 1992 QUANTITY (T) MAX	TREATMENT AND DISPOSAL % OR REMAINDER FROM 4Rs ON-SITE MAX	% OR REMAINDER FROM 4Rs OFF-SITE MAX	1992 QUANTITY (T) ON-SITE MAX	1992 QUANTITY (T) ON-SITE MIN	1992 QUANTITY (T) OFF-SITE MAX	1992 QUANTITY (T) OFF-SITE MIN
Current Regulations:													
282[2]	251	850	950	25	25	238	238	100	100	713	0	713	0
SUB-TOTAL		850	950			238	238			713	0	713	0
Enhanced Regulations:													
133	111	219	258	0	0	0	0	10	100	26	0	258	233
111	112	141	166	0	0	0	0	100	100	166	0	166	0
112	113	3	4	0	0	0	0	100	100	4	0	4	0
121	121	13	15	0	0	0	0	100	100	15	0	15	0
122	122	7	8	0	0	0	0	100	100	8	0	8	0
214	213	3	4	0	0	0	0	0	100	0	0	4	4
281	251	338	399	25	25	100	100	100	100	299	0	299	0
282	221	15	18	0	0	0	0	0	100	0	0	18	18
224	267	20 724	24 459	0	25	0	6 115	50	100	12 229	0	24 459	9 172
523	270	33 809	39 902	0	0	0	0	100	100	39 902	0	39 902	0
SUB-TOTAL		55 272	65 232			100	6 214			52 650	0	65 133	9 426
TOTAL		56 122	66 182			337	6 452			53 362	0	65 845	9 426

Notes:

[1] Off-site Dust Suppression Quantity is assumed to grow 2.8% annually since 1986 (except UCD 282). 1992 estimate for UCD 282 provided by VHB Research.

[2] Waste not permitted for use as off-site dust suppression as a result of 1988 legislation change.

TABLE 18

Allocation of Off-Site Dust Suppression Wastes - 1997

WASTE CLASS UCD	WASTE CLASS MOE	1986 QUANTITY (T)	1997[1] QUANTITY (T)	4Rs % OF 1997 QUANTITY LIKELY	4Rs % OF 1997 QUANTITY MAX	4Rs 1997 QUANTITY (T) LIKELY	4Rs 1997 QUANTITY (T) MAX	TREATMENT AND DISPOSAL % OR REMAINDER FROM 4Rs ON-SITE MAX	% OR REMAINDER FROM 4Rs OFF-SITE MAX	1997 QUANTITY (T) ON-SITE MAX	1997 QUANTITY (T) ON-SITE MIN	1997 QUANTITY (T) OFF-SITE MAX	1997 QUANTITY (T) OFF-SITE MIN
Current Regulations:													
282	251	850	1 050	25	25	263	263	100	100	788	0	788	0
SUB-TOTAL		850	1 050			263	263			788	0	788	0
Enhanced Regulations:													
133	111	219	290	0	0	0	0	10	100	29	0	290	261
111	112	141	187	0	0	0	0	100	100	187	0	187	0
112	113	3	4	0	0	0	0	100	100	4	0	4	0
121	121	13	17	0	0	0	0	100	100	17	0	17	0
122	122	7	9	0	0	0	0	100	100	9	0	9	0
214	213	3	4	0	0	0	0	0	100	0	0	4	4
282	251	338	448	25	25	112	112	100	100	336	0	336	0
281	221	15	20	0	0	0	0	0	100	0	0	20	20
224	267	20 724	27 485	0	25	0	6 871	50	100	13 742	0	27 485	10 307
523	270	33 809	44 839	0	0	0	0	100	100	44 839	0	44 839	0
SUB-TOTAL		55 272	73 304			112	6 983			59 164	0	73 192	10 592
TOTAL		56 122	74 354			375	7 246			59 951	0	73 979	10 592

Notes:

[1] Off-site Dust Suppression Quantity is assumed to grow 2.6% annually since 1986 (except UCD 282). 1997 estimate for UCD 282 was provided by VHB Research.

[2] Waste not permitted for use as off-site dust suppression as a result of a 1988 legislation change.

specific processes are proprietary, the participants believed that such on-site technologies include forms of solidification or leaching). However, since most generators of this waste are small, a 10% maximum on-site treatment and disposal allocation was selected. Given available facilities, it was felt that all of the wastes could be managed off-site.

- UCD 433

  It was noted that most of this waste would be produced by iron and steel companies. It was argued that no 4Rs potential exists since it is not presently possible to separate lead and zinc from iron. It was noted that blending of this waste could result in the waste being considered non-toxic. Therefore, the maximum on-site allocation was taken to be 100% (none would go off-site).

- UCDs 286 and 288 (biological sludges and miscellaneous solids)

  It was noted that this waste consisted of solids and clarifier sludges from a biosystem and oil and grease from industrial biological systems. It was argued that there is no 4Rs potential for the waste since nothing in it is of value to recover. It was noted that many on-site treatment alternatives exist for biological sludges, however, none could be identified for inert solids. Biological treatment is only partial (i.e. it cannot stabilize waste since some metal content will remain). Thus, if 100% of this waste is treated on-site, 50% of the residuals would seek further off-site treatment. Thus, a maximum allocation of 50% to on-site treatment and disposal was selected. Given available facilities, all of this waste could be managed off-site.

The allocations of the MISA residuals are summarized in Tables 17 through 20 for the high and low quantity estimates for the respective years. The method of development is identical to that used in Table 6, as described in Section 7.2.

TABLE 17

Allocation of MISA Wastes - 1992
(High Quantity Estimate)

UCD WASTE CLASS	1992 QUANTITY (T)	4Rs % OF TOTAL QUANTITY LIKELY	4Rs % OF TOTAL QUANTITY MAX	4Rs 1992 QUANTITY (T) LIKELY	4Rs 1992 QUANTITY (T) MAX	TREATMENT AND DISPOSAL % OF REMAINDER FROM 4Rs ON-SITE MAX	% OF REMAINDER FROM 4Rs OFF-SITE MAX	1992 QUANTITY (T) ON-SITE MAX	ON-SITE MIN	OFF-SITE MAX	OFF-SITE MIN
431	6 160	25	75	1 540	4 620	10	100	426	0	4 620	1 386
433	15 527	0	0	0	0	100	0	15 527	15 527	0	0
286	12 706	0	0	0	0	50	100	6 353	0	12 706	6 353
288	12 706	0	0	0	0	50	100	6 353	0	12 706	6 353
TOTAL	47 099			1 540	4 620			28 695	15 527	30 032	14 092

TABLE 18

Allocation of MISA Wastes - 1992.
(Low Quantity Estimate)

UCD WASTE CLASS	1992 QUANTITY (T)	4Rs % OF TOTAL QUANTITY LIKELY	4Rs % OF TOTAL QUANTITY MAX	4Rs 1992 QUANTITY (T) LIKELY	4Rs 1992 QUANTITY (T) MAX	TREATMENT AND DISPOSAL % OF REMAINDER FROM 4Rs ON-SITE MAX	% OF REMAINDER FROM 4Rs OFF-SITE MAX	1992 QUANTITY (T) ON-SITE MAX	ON-SITE MIN	OFF-SITE MAX	OFF-SITE MIN
431	3 215	25	75	804	2 411	10	100	241	0	2 411	723
433	15 198	0	0	0	0	100	0	15 198	15 198	0	0
286	8 022	0	0	0	0	50	100	4 011	0	8 022	4 011
288	8 022	0	0	0	0	50	100	4 011	0	8 022	4 011
TOTAL	34 457			804	2 411			23 461	15 198	18 455	8 745

TABLE 19

Allocation of MISA Wastes - 1997
(High Quantity Estimate)

UCD WASTE CLASS	1997 QUANTITY (T)	4Rs: % OF TOTAL QUANTITY LIKELY	4Rs: % OF TOTAL QUANTITY MAX	4Rs: 1997 QUANTITY (T) LIKELY	4Rs: 1997 QUANTITY (T) MAX	TREATMENT AND DISPOSAL: % OF REMAINDER FROM 4Rs ON-SITE MAX	% OF REMAINDER FROM 4Rs OFF-SITE MAX	1997 QUANTITY (T) ON-SITE MAX	1997 QUANTITY (T) ON-SITE MIN	1997 QUANTITY (T) OFF-SITE MAX	1997 QUANTITY (T) OFF-SITE MIN
431	6 508	25	75	1 627	4 881	10	100	488	0	4 881	1 464
433	16 578	0	0	0	0	100	0	16 578	16 578	0	0
286	13 520	0	0	0	0	50	100	6 760	0	13 520	6 760
288	13 520	0	0	0	0	50	100	6 760	0	13 520	6 760
TOTAL	50 126			1 627	4 881			30 586	16 578	31 921	14 984

TABLE 20

Allocation of MISA Wastes - 1997
(Low Quantity Estimate)

UCD WASTE CLASS	1997 QUANTITY (T)	4Rs: % OF TOTAL QUANTITY LIKELY	4Rs: % OF TOTAL QUANTITY MAX	4Rs: 1997 QUANTITY (T) LIKELY	4Rs: 1997 QUANTITY (T) MAX	TREATMENT AND DISPOSAL: % OF REMAINDER FROM 4Rs ON-SITE MAX	% OF REMAINDER FROM 4Rs OFF-SITE MAX	1997 QUANTITY (T) ON-SITE MAX	1997 QUANTITY (T) ON-SITE MIN	1997 QUANTITY (T) OFF-SITE MAX	1997 QUANTITY (T) OFF-SITE MIN
431	3 391	25	75	848	2 543	10	100	254	0	2 543	763
433	16 226	0	0	0	0	100	0	16 226	16 226	0	0
286	8 526	0	0	0	0	50	100	4 263	0	8 526	4 263
288	8 526	0	0	0	0	50	100	4 263	0	8 526	4 263
TOTAL	36 669			848	2 543			25 006	16 226	19 595	9 289

7.10 PUBLIC LANDFILL STREAM

The wastes of interest in this allocation result from a possible organics ban from landfills. As such, the organics presently being disposed of untreated in off-site public landfills (both commercial and municipal) would seek an alternate destination. The analysis approach used was to examine large waste streams (greater than 1 000 tonnes per year) and determine the likely and maximum allocation to 4Rs and the maximum allocation to on-site treatment and disposal (the market assessment model was used as a benchmark). Since the waste is currently being hauled offsite, the maximum off-site allocation in every case is 100%. The allocations for small streams was taken as the weighted average of the larger streams examined for each destination.

The specific allocations arguments by "large" waste stream are presented below:

- MOE 263: (organic laboratory chemicals)

  It was felt that due to the severely hazardous characteristics of this waste, the 4Rs and on-site treatment and disposal opportunities would be limited. Given acceptable off-site treatment, the other alternatives would be uneconomical since waste streams are generally quite small. Therefore, all of it would be managed by off-site treatment and disposal.

- MOE 222: (heavy fuels)

  While it was felt that there would likely be no 4Rs activities for this stream due to small quantities and current practices (if it were possible to apply 4Rs now, it would be done), some potential was felt

to exist (particularly if costs of alternatives increases). The remaining waste was felt to likely entirely go off-site (consistent with the export waste allocation) due to limited on-site alternatives.

- MOE 251: (oil skimmings and sludges)

  Since the present destination is Tricil's landfill, it was assumed that these streams were primarily sludges. Although no 4Rs activities would likely take place due to limited alternatives, it was felt that some future potential would exist. The model indicated that only 10% would be treated on-site. The experts felt that a maximum of 50% would be a more conservative reflection of the specific nature of the waste (there are more technologies that could be economical).

- MOE 270: (other specified organics)

  Very little likely 4Rs activities were anticipated for this stream due to limited opportunities and generally small stream sizes although there is some potential. The wastes that are treated in this stream would almost certainly go off-site (consistent with the export analysis) since on-site practices would be uneconomical at the scale envisioned.

- MOE 145: (paint/pigment/coating residues)

  A similar allocation argument as for MOE 270 wastes was made since it was felt that the wastes were similar in nature. It was noted that this differs from the allocation of this stream for exported waste. The rationale for this difference rested on the fact that different present destinations point to different specific characteristics of the waste (i.e. it currently goes to Tricil).

Based on the MOE manifest receiver file VHB Research and Consulting Inc. estimated that approximately 82 000 tonnes of waste were disposed of in public landfills in 1986. Of this approximately 28 000 tonnes would potentially seek off-site treatment and disposal due to an organics ban from landfills under enhanced regulations. This estimate increases to 33 200 tonnes by 1992 and 37 000 by 1997. The 1986 quantity was factored by 2.4% annually through to 1997.

Summaries of the public landfill allocation exercise are presented in Tables 21 and 22 for 1992 and 1997 respectively. The method used to develop these tables is the same as that used for Table 6 (see discussion in Section 7.2).

7.11 PRIVATE LANDFILL STREAM

This waste stream was developed considering possible regulatory enhancements similar to the HSWA amendments to RCRA in the U.S. An identical analysis was used for these wastes as described above for public landfill streams. The specific arguments regarding the allocation of "large" streams are presented below:

- MOE 122: (alkaline waste - other metals)

  This waste comes primarily from large industries with advanced on-site capabilities and is currently being sent to off-site disposal despite existing 4Rs alternatives. Thus, the likely allocation to 4Rs was taken to be zero with some potential. The on-site model allocation of 100% is applied here as a reasonable maximum for the above reasons.

TABLE 21

Allocation of Public Landfill Wastes - 1992

WASTE CLASS		1986 LANDFILL QUANTITY	1992[1] LANDFILL QUANTITY	4Rs				TREATMENT AND DISPOSAL					
				% OF 1992 QUANTITY		1992 QUANTITY (T)		% OR REMAINDER FROM 4Rs		1992 QUANTITY (T)			
UCD	MOE	(T)	(T)	LIKELY	MAX	LIKELY	MAX	ON-SITE MAX	OFF-SITE MAX	ON-SITE MAX	ON-SITE MIN	OFF-SITE MAX	OFF-SITE MIN
214	211	315	363	0	15	0	54	30	100	109	0	363	216
224	268	174	201	0	15	0	30	30	100	60	0	201	119
241	242	197	227	0	15	0	34	30	100	68	0	227	135
245	263	2 203	2 540	0	0	0	0	0	100	0	0	2 540	2 540
254	265	17	20	0	15	0	3	30	100	6	0	20	12
257	266	145	167	0	15	0	25	30	100	50	0	167	99
258	222	1 788	2 061	0	25	0	515	0	100	0	0	2 061	1 546
261	232	396	457	0	15	0	68	30	100	137	0	457	272
262	231	156	180	0	15	0	27	30	100	54	0	180	107
263	233	944	1 088	0	15	0	163	30	100	327	0	1 088	648
281	221	892	1 028	0	15	0	154	30	100	309	0	1 028	612
282	251	5 362	6 182	0	25	0	1 545	50	100	3 091	0	6 182	2 318
284	254	58	67	0	15	0	10	30	100	20	0	67	40
289	253	188	217	0	15	0	33	30	100	65	0	217	129
225	262	48	55	0	15	0	8	30	100	17	0	55	33
431	141	63	73	0	15	0	11	30	100	22	0	73	43
431	142	41	47	0	15	0	7	30	100	14	0	47	28
523	270	5 574	6 426	0	25	0	1 607	0	100	0	0	6 426	4 820
454	145	10 263	11 832	0	10	0	1 183	0	100	0	0	11 832	10 649
TOTAL		28 824	33 232			0	5 479			4 348	0	33 232	24 366

Notes:

[1] Public Landfill Stream Quantity is assumed to grow 2.4% annually since 1986

TABLE 22

Allocation of Public Landfill Wastes - 1997

WASTE CLASS		1986 LANDFILL QUANTITY	1997[1] LANDFILL QUANTITY	4Rs				TREATMENT AND DISPOSAL					
				% OF 1997 QUANTITY		1997 QUANTITY (T)		% OR REMAINDER FROM 4Rs		1997 QUANTITY (T)			
UCD	MOE	(T)	(T)	LIKELY	MAX	LIKELY	MAX	ON-SITE MAX	OFF-SITE MAX	ON-SITE MAX	ON-SITE MIN	OFF-SITE MAX	OFF-SITE MIN
214	211	315	409	0	15	0	61	30	100	123	0	409	243
224	268	174	226	0	15	0	34	30	100	68	0	226	134
241	242	197	256	0	15	0	38	30	100	77	0	256	152
245	263	2 203	2 860	0	0	0	0	0	100	0	0	2 860	2 860
254	265	17	22	0	15	0	3	30	100	7	0	22	13
257	266	145	188	0	15	0	28	30	100	56	0	188	112
258	222	1 788	2 321	0	25	0	580	0	100	0	0	2 321	1 741
261	232	396	514	0	15	0	30	30	100	61	0	202	120
262	231	156	202	0	15	0	30	30	100	61	0	202	120
263	233	944	1 225	0	15	0	184	30	100	368	0	1 225	729
281	221	892	1 158	0	15	0	174	30	100	347	0	1 158	689
282	251	5 382	6 960	0	25	0	1 740	50	100	3 480	0	6 960	2 610
284	254	58	75	0	15	0	11	30	100	23	0	75	45
289	253	188	244	0	15	0	37	30	100	73	0	244	145
225	262	48	62	0	15	0	9	30	100	19	0	62	37
431	141	63	82	0	15	0	12	30	100	25	0	82	49
431	142	41	53	0	15	0	8	30	100	16	0	53	32
523	270	5 574	7 235	0	25	0	1 809	0	100	0	0	7 235	5 427
454	145	10 263	13 322	0	10	0	1 332	0	100	0	0	13 322	11 990
TOTAL		28 824	37 416			0	6 169			4 895	0	37 416	27 434

Notes:

[1] Public Landfill Stream Quantity is assumed to grow 2.4% annually since 1986

- MOE 133: (brines, chlor-alkali wastes)

  As above, the on-site capability is advanced for the larger industries that generate the waste. Thus, on-site treatment and disposal will be the likely management alternative. Given limited 4Rs alternatives and economical on-site treatment options, the likely and maximum allocation to 4Rs was taken to be zero. The on-site treatment and disposal maximum was taken as 100%.

- MOE 146: (other specified inorganics)

  Given the current destination and considering the number of small generators, neither 4Rs nor on-site treatment and disposal were considered.

- MOE 241: (hologenated solvents)

  The 4Rs potential for this waste is extremely limited due to limited opportunities and significant economical on-site treatment options (few large industries generate this waste). Given these opportunities, the on-site maximum allocation was taken as 100%.

- MOE 231: (latex solvents)

  Due to the highly hazardous nature of this waste, it was concluded that no 4Rs potential existed. Also, since the waste generators are typically small industries with few technically feasible alternatives, the maximum on-site treatment and disposal allocation was taken to be 0%.

- MOE 251: (oil skimmings and sludges)

  Since this waste could be used as boiler fuel (considered to be an on-site treatment and disposal alternative), the 4Rs potential for this waste was taken to be quite limited (some potential for reduction). Given the on-site opportunities, the on-site treatment and disposal allocation was taken to be 100%.

- MOE 270: (other specified organics)

  Given small waste generators and limited technical opportunities for 4Rs, the likely 4Rs allocation was taken to be zero. Some potential exists for reduction, given appropriate economic incentives. The on-site allocation would be negligible due to more economical off-site options.

Based on the MOE manifest receiver file VHB Research and Consulting Inc. estimated that approximately 49 000 tonnes were going off-site to private landfills in 1986. Virtually all of this waste would potentially seek off-site treatment and disposal due to enhanced regulations. This estimate increases to 58 400 tonnes by 1992 and 64 100 by 1997. the 1986 quantity was factored by an annual growth rate of 3.0% from 1986 to 1992 and by 2.5% from 1986 to 1997.

The results of the private landfill allocation exercise are presented in Tables 23 and 24 for 1992 and 1997 respectively. The method used to develop these tables is the same as that used for Table 6 (see discussion in Section 7.2). It should be mentioned that MOE 266 (UCD 257) was missing from previous versions of this workshop report. Quantities of MOE 222 (UCD 258) have also been adjusted.

TABLE 23

Allocation of Private Landfill Wastes - 1992

WASTE CLASS		1986 LANDFILL QUANTITY (T)	1992[1] LANDFILL QUANTITY (T)	4Rs				TREATMENT AND DISPOSAL					
				% OF 1992 QUANTITY		1992 QUANTITY (T)		% OR REMAINDER FROM 4Rs		1992 QUANTITY (T)			
UCD	MOE			LIKELY	MAX	LIKELY	MAX	ON-SITE MAX	OFF-SITE MAX	ON-SITE MAX	ON-SITE MIN	OFF-SITE MAX	OFF-SITE MIN
122	122	5 446	6 503	0	25	0	1 626	100	100	6 503	0	6 503	0
145	133	3 722	4 444	0	0	0	0	100	100	4 444	0	4 444	0
151	146	5 881	7 022	0	0	0	0	0	100	0	0	7 022	7 022
167	150	33	39	0	10	0	4	60	100	24	0	39	14
211	241	6 960	8 311	0	10	0	831	100	100	8 311	0	8 311	0
252	311	86	103	0	20	0	21	60	100	62	0	103	33
257	266	9	11	0	20	0	2	60	100	6	0	11	3
258	222	99	118	0	20	0	24	60	100	71	0	118	38
261	232	113	135	0	20	0	27	60	100	81	0	135	43
262	231	5 248	6 266	0	0	0	0	0	100	0	0	6 266	6 266
263	233	232	277	0	20	0	55	60	100	166	0	277	89
281	221	470	561	0	20	0	112	60	100	337	0	561	180
281	252	8	10	0	20	0	2	60	100	6	0	10	3
282	251	11 044	13 187	0	25	0	3 297	100	100	13 187	0	13 187	0
284	254	50	60	0	20	0	12	60	100	36	0	60	19
289	253	408	487	0	20	0	97	60	100	292	0	487	156
431	142	45	54	0	20	0	11	60	100	32	0	54	17
523	270	7 776	9 285	0	25	0	2 321	0	100	0	0	9 285	6 964
454	145	1 248	1 490	0	10	0	1 490	100	100	1 489	0	1 490	0
TOTAL		48 878	58 363			0	8 591			35 048	0	58 363	20 487

Notes:

[1] Private Landfill Waste Quantity is assumed to grow 3.0% annually since 1986

TABLE 24

Allocation of Private Landfill Wastes - 1997

WASTE CLASS		1986 LANDFILL QUANTITY	1997[1] LANDFILL QUANTITY	4Rs				TREATMENT AND DISPOSAL					
				% OF 1997 QUANTITY		1997 QUANTITY (T)		% OR REMAINDER FROM 4Rs		1997 QUANTITY (T)			
UCD	MOE	(T)	(T)	LIKELY	MAX	LIKELY	MAX	ON-SITE MAX	OFF-SITE MAX	ON-SITE MAX	ON-SITE MIN	OFF-SITE MAX	OFF-SITE MIN
122	122	5 446	7 146	0	25	0	1 786	100	100	7 146	0	7 146	0
145	133	3 722	4 884	0	0	0	0	100	100	4 884	0	4 884	0
151	146	5 881	7 716	0	0	0	0	0	100	0	0	7 716	7 716
167	150	33	43	0	10	0	4	60	100	26	0	43	16
211	241	6 960	9 132	0	10	0	913	100	100	9 132	0	9 132	0
252	311	86	113	0	20	0	23	60	100	68	0	113	38
257	266	9	12	0	20	0	2	60	100	7	0	12	4
258	222	99	130	0	20	0	26	60	100	78	0	130	42
261	232	113	148	0	20	0	30	60	100	89	0	148	47
262	231	5 248	6 886	0	0	0	0	0	100	0	0	6 886	6 886
263	233	232	304	0	20	0	61	60	100	183	0	304	97
281	221	470	617	0	20	0	123	60	100	370	0	617	197
281	252	8	10	0	20	0	2	60	100	6	0	10	3
282	251	11 044	14 491	0	25	0	3 623	100	100	14 491	0	14 491	0
284	254	50	66	0	20	0	13	60	100	39	0	66	21
289	253	408	535	0	20	0	107	60	100	321	0	535	171
431	142	45	59	0	20	0	12	60	100	35	0	59	19
523	270	7 776	10 203	0	25	0	2 551	0	100	0	0	10 203	7 652
454	145	1 248	1 637	0	10	0	164	100	100	1 637	0	1 637	0
TOTAL		48 887	64 132			0	9 440			38 512	0	64 132	22 908

Notes:

[1] Private Landfill Waste Quantity is assumed to grow 2.5% annually since 1986

7.12 WATER POLLUTION CONTROL PLANT WASTES

This exercise began with an introduction of an analysis of existing wastes currently being hauled to water pollution control plants (WPCP). The analysis identified waste streams that could require reallocation due to enhanced regulation. The approach used was identical to that used for landfill wastes except that the on-site maximum allocation for small streams (under 1000 tonnes per year) was taken from the market assessment model. The specific allocation arguments for large streams are presented below:

- MOE 111: (spent pickle liquor)

  Most felt that the contaminated portion of this waste would be so small as to be virtually unnoticeable given the existing destination. Therefore, it was judged that all of this waste would be managed through 4Rs.

- MOE 262: (detergents/soaps)

  It was felt that this waste stream would all go to off-site treatment and disposal (no 4Rs or on-site potential) due to the limited size of generators producing this waste and limited alternatives.

- MOE 266: (phenolic wastes)

  This is primarily one large phenolic waste stream going to the Kitchener WPCP. Based on participant knowledge of that operation, the waste would not likely be covered by enhanced regulations (liquid non-hazardous waste that is hauled because there is no sewer connection). Therefore, it was felt that all of this waste would be treated on-site (no off-site or 4Rs potential).

Based on the MOE manifest receiver file VHB Research and Consulting Inc. estimated that approximately 293 000 tonnes were going off-site to water pollution control plants in 1986. The workshop participants determined that approximately 62 600 tonnes of this would potentially seek off-site treatment and disposal under committed enhanced regulations. This estimate increases to 69 000 tonnes by 1992 and to 75 800 by 1997. The 1986 quantity was factored by 1.9% through to 1997.

The results of the water pollution control plant waste allocation are presented in Tables 25 and 26 for 1992 and 1997 respectively. The method used to develop these tables is the same as that used for Table 6 (see discussion in Section 7.2).

7.13 WASTE DUE TO ECONOMIC GROWTH

A discussion of economic growth and its effects on waste generation focused on two types of growth. First, growth can be a result of increased usage of existing facilities. Second, growth can occur through new industrial development. It was felt that the additional waste due to growth of the former kind would be allocated to alternative practices in the same proportion as at present. Growth of the latter kind was felt by many to create no new waste (due to improved process designs). An analytical problem is that there was no means of determining what portion of growth would be due to the two alternate modes.

In the absence of firm data, it was assumed that 50% of the growth would be through new industrial development. Thus, the determination of the growth of wastes from different sources involved a simple mathematical procedure. The total quantity of waste, by source, was first disaggregated by SIC class. For each SIC class, an economic growth rate divided by two

TABLE 25

Allocation of Water Pollution Control Plant Wastes - 1992

WASTE CLASS UCD	WASTE CLASS MOE	1986 QUANTITY OF INTEREST (T)	1992[1] QUANTITY OF INTEREST (T)	4Rs % OF 1992 QUANTITY LIKELY	4Rs % OF 1992 QUANTITY MAX	4Rs 1992 QUANTITY (T) LIKELY	4Rs 1992 QUANTITY (T) MAX	TREATMENT AND DISPOSAL % OR REMAINDER FROM 4Rs ON-SITE MAX	% OR REMAINDER FROM 4Rs OFF-SITE MAX	1992 QUANTITY (T) ON-SITE MAX	1992 QUANTITY (T) ON-SITE MIN	1992 QUANTITY (T) OFF-SITE MAX	1992 QUANTITY (T) OFF-SITE MIN
133	111	2 249	2 518	100	100	2 518	2 518	-	-	0	0	0	0
113	114	356	399	0	0	0	0	65	100	259	0	399	139
121	121	8	9	0	0	0	0	90	100	8	0	9	1
122	122	139	156	0	0	0	0	95	100	148	0	156	8
167	150	196	219	0	0	0	0	0	100	0	0	219	219
214	211	345	386	0	0	0	0	100	100	386	0	386	0
281	221	5	6	0	0	0	0	0	100	0	0	6	6
284	254	339	380	0	0	0	0	100	0	380	380	0	0
225	262	1 029	1 152	0	0	0	0	0	100	0	0	1 152	1 152
245	263	14	16	0	0	0	0	0	100	0	0	16	16
254	265	16	18	0	0	0	0	0	100	0	0	18	18
257	266	56 891	63 693	0	0	0	0	100	0	63 693	63 693	0	0
523	270	5	6	0	0	0	0	0	100	0	0	6	6
TOTAL		61 592	68 956			2 518	2 518			64 873	64 072	2 366	1 564

Notes:

[1] Water Pollution Control Plant Waste Quantity is assumed to grow 1.9% annually since 1986.

TABLE 26

Allocation of Water Pollution Control Plant Wastes - 1997

WASTE CLASS UCD	WASTE CLASS MOE	1986 QUANTITY OF INTEREST (T)	1997[1] QUANTITY OF INTEREST (T)	4Rs % OF 1997 QUANTITY LIKELY	4Rs % OF 1997 QUANTITY MAX	4Rs 1997 QUANTITY (T) LIKELY	4Rs 1997 QUANTITY (T) MAX	TREATMENT AND DISPOSAL % OR REMAINDER FROM 4Rs ON-SITE MAX	% OR REMAINDER FROM 4Rs OFF-SITE MAX	1997 QUANTITY (T) ON-SITE MAX	1997 QUANTITY (T) ON-SITE MIN	1997 QUANTITY (T) OFF-SITE MAX	1997 QUANTITY (T) OFF-SITE MIN
133	111	2 249	2 766	100	100	2 766	2 766	-	-	0	0	0	0
113	114	356	438	0	0	0	0	65	100	285	0	438	153
121	121	8	10	0	0	0	0	90	100	9	0	10	1
122	122	139	171	0	0	0	0	95	100	162	0	171	9
167	150	196	241	0	0	0	0	0	100	0	0	241	241
214	211	345	424	0	0	0	0	100	100	424	0	424	0
281	221	5	6	0	0	0	0	0	100	0	0	6	6
284	254	339	417	0	0	0	0	100	0	417	417	0	0
225	262	1 029	1 266	0	0	0	0	0	100	0	0	1 266	1 266
245	264	14	17	0	0	0	0	0	100	0	0	17	17
254	265	16	20	0	0	0	0	0	100	0	0	20	20
257	266	56 891	69 978	0	0	0	0	100	0	69 978	69 978	0	0
523	270	5	6	0	0	0	0	0	100	0	0	6	6
TOTAL		62 592	75 760			2 766	2 766			71 275	70 395	2 599	1 719

Notes:

[1] Water Pollution Control Plant Waste Quantity is assumed to grow 1.9% annually since 1986.

was taken to be the waste growth rate. The growth rate for the total waste in each source was then taken as the weighted average of the individual waste growth rates (weighted by the quantity of waste in each SIC class). These growth rates have been reflected in numerous tables named above.

Growth in waste streams not considered above (i.e. wastes that are expected to continue going to their current destinations) was not considered (i.e. assumes no capacity constraints). One exception is the growth in wastes currently going to Tricil's incinerator. Since Tricil's incinerator is close to its thermal capacity, growth in that stream may have to be allocated to alternative practices in time.

Potential growth in organic waste streams presently going to Tricil's incinerator was considered by examining each stream to determine what the allocation of that waste might be. The growth portion of each stream would be expected to be allocated in this manner. Since the waste is currently going to an off-site incinerator, it was felt that all wastes requiring treatment and disposal would go off-site. The allocation exercise, therefore, simply involved a discussion of 4Rs potential. A summary of these arguments is presented below by waste type:

- MOE 211: (aromatic solvents)

  Tricil would likely market very competitively to get this waste. Therefore, the 4Rs potential is quite limited (10% maximum is assumed).

- MOE 212: (aliphatic solvents)

  Same as for MOE Class 211.

- MOE 251: (oil skimmings and sludges)

  Resource recovery would be difficult based on existing technologies. A greater 4Rs potential exists for this waste as Tricil would be less sensitive to competing for it.

- MOE 261: (pharmaceuticals)

  A very limited potential for 4Rs exists as this waste is very difficult to handle.

- MOE 266: (phenolic wastes)

  One participant knew of at least one large generator that is considering recovery/recycling for this stream. Therefore, a more sizeable 4Rs allocation was deemed reasonable as a conservative approach.

- MOE 268: (amines)

  Same as for MOE Class 211.

- MOE 282: (non-halogenated lean organics)

  Some dewatering potential exists. However, existing practice indicates that generators pay a great deal to get rid of this waste. Therefore, off-site treatment practices would be dominant.

- MOE 281: (non-halogenated rich organics)

  Similar to MOE 282, except a likely higher amount could be reduced through dewatering.

Summaries of this analysis are presented in Tables 27 and 28 for 1992 and 1997 respectively. The method used to develop these tables is the same as for Table 6 (see discussion in Section 7.2) except that only the growth quantities (column 5) are considered when computing allocations to alternative practices.

7.14 SUMMARY

Arguments for the allocation of waste between various practices for specific waste streams of interest have already been presented on a disaggregate basis. This section presents the results of the aggregation of the quantities for each waste source of interest.

The different waste sources were examined based on the premise that under different regulatory scenarios they would have to be reallocated from their present destination. Some streams, including incremental site cleanup and decommissioning wastes, MISA residuals, water pollution control plant wastes, PCBs in storage/use, household wastes, wastes due to economic growth, export wastes and some of dust suppression wastes require reallocation under current regulations. Other streams, including public, on-site and private landfill wastes and off-site dust suppression wastes would require reallocation only under proposed enhanced regulations.

Table 29 summarizes the allocation of wastes generated in 1992. For waste sources where high and low quantity estimates were developed (i.e. site cleanup and decommissioning, MISA residuals and household wastes), the high quantity estimates are applied. This table basically abstracts the total quantities summarized from Tables 6, 8, 10, 12, 13, 15, 17, 21, 23, 25 and 27.

TABLE 27

Allocation of Economic Growth Wastes (Tricil) - 1992

WASTE CLASS UCD	WASTE CLASS MOE	1986 QUANTITY INCIN. (T)	1992 QUANTITY INCIN. (T)[a]	GROWTH QUANTITY OF INTEREST (T)[b]	4Rs % OF 1992 QUANTITY LIKELY	4Rs % OF 1992 QUANTITY MAX	4Rs 1992 QUANTITY (T) LIKELY	4Rs 1992 QUANTITY (T) MAX	TREATMENT AND DISPOSAL % OR REMAINDER FROM 4Rs ON-SITE MAX	% OR REMAINDER FROM 4Rs OFF-SITE MAX	1992 QUANTITY (T) ON-SITE MAX	1992 QUANTITY (T) ON-SITE MIN	1992 QUANTITY (T) OFF-SITE MAX	1992 QUANTITY (T) OFF-SITE MIN
214	211	11 505	13 578	2 073	5	10	104	207	0	100	0	0	1 969	1 866
214	212	5 003	5 905	902	5	10	45	90	0	100	0	0	857	812
282	251	5 268	6 217	949	5	20	47	190	0	100	0	0	902	759
243	261	6 353	7 498	1 145	5	5	57	57	0	100	0	0	1 088	1 088
257	266	3 165	3 735	570	20	20	114	114	0	100	0	0	456	456
224	268	2 355	2 779	424	5	10	21	42	0	100	0	0	403	382
225	282	11 693	13 800	2 107	10	20	211	421	0	100	0	0	1 896	1 686
227	281	2 383	2 812	429	15	20	64	86	0	100	0	0	365	343
TOTAL		47 725	56 324	8 599			663	1 207			0	0	7 936	7 392

Notes:

[a] Incineration waste quantities are assumed to grow 2.8% annually since 1986.

[b] The growth component is the difference between the 1992 and 1986 quantities.

TABLE 28

Allocation of Economic Growth Wastes (Tricil) - 1997

WASTE CLASS UCD	WASTE CLASS MOE	1986 QUANTITY INCIN. (T)	1997 QUANTITY INCIN. (T)[a]	GROWTH QUANTITY OF INTEREST (T)[b]	4Rs % OF 1997 QUANTITY LIKELY	4Rs % OF 1997 QUANTITY MAX	4Rs 1997 QUANTITY (T) LIKELY	4Rs 1997 QUANTITY (T) MAX	TREATMENT AND DISPOSAL % OR REMAINDER FROM 4Rs ON-SITE MAX	% OR REMAINDER FROM 4Rs OFF-SITE MAX	1997 QUANTITY (T) ON-SITE MAX	1997 QUANTITY (T) ON-SITE MIN	1997 QUANTITY (T) OFF-SITE MAX	1997 QUANTITY (T) OFF-SITE MIN
214	211	11 505	15 589	4 084	5	10	204	408	0	100	0	0	3 880	3 675
214	212	5 003	6 779	1 776	5	10	89	178	0	100	0	0	1 687	1 598
282	251	5 268	7 138	1 870	5	20	93	374	0	100	0	0	1 776	1 496
243	261	6 353	8 608	2 255	5	5	113	113	0	100	0	0	2 142	2 142
257	266	3 165	4 288	1 123	20	20	225	225	0	100	0	0	899	899
224	268	2 355	3 191	836	5	10	42	84	0	100	0	0	794	752
225	282	11 693	15 843	4 150	10	20	415	830	0	100	0	0	3 735	3 320
227	281	2 383	3 229	846	15	20	127	169	0	100	0	0	719	677
TOTAL		47 725	64 665	16 940			1 308	2 380			0	0	15 633	14 560

Notes:

[a] Incineration waste quantities are assumed to grow 2.8% annually since 1986.

[b] The growth component is the difference between the 1997 and 1986 quantities.

Table 30 summarizes the allocation of the low quantity estimates in 1992. The only differences between Tables 29 and 30 are the quantities of MISA residuals, site cleanup and decommissioning wastes, household wastes and column totals. The allocations of low quantity estimates of MISA residuals, site cleanup and decommissioning wastes are abstracted from Tables 17 and 13 respectively. Those for household wastes are derived by taking one-tenth of all the relevant quantities in Table 11.

In both tables, the quantities are totalled for waste sources corresponding to regulations, sources corresponding to enhanced regulations and all sources. It can be seen from these tables that the minimum allocation to off-site treatment and disposal is approximately 57 000 tonnes per annum (the off-site minimum from wastes due to existing regulations) by 1992. The maximum off-site allocation is approximately 387 000 tonnes per annum (the off-site maximum for wastes due to existing plus enhanced regulations). Also noteworthy is that the allocation to 4Rs ranges from 27 000 to 86 000 tonnes per annum.

Similar summaries for 1997 quantities are presented in Tables 31 and 32. It is anticipated that the allocations to off-site treatment and disposal would range from 67 000 to 428 000 tonnes per annum by 1997.

TABLE 29

Waste Allocation Quantities
1992 Annual Tonnes (High)[1,2,4]

SOURCE	QUANTITY	STORAGE	4Rs LIKELY	4Rs POTENTIAL	TREATMENT AND DISPOSAL ON-SITE MAXIMUM	ON-SITE MINIMUM	OFF-SITE MAXIMUM	OFF-SITE MINIMUM
Current Regulations								
o Site Cleanup & Decommissioning Waste	47 000	2 470	0	892	17 805	0	44 530	26 056
o MISA Residuals	47 099	0	1 540	4 620	28 695	15 527	30 032	14 092
o WPCP Wastes	68 956	0	2 518	2 518	64 873	64 072	2 366	1 564
o PCB's in Storage/Use	3 830	0	0	0	2 850	0	3 830	980
o Household	5 000	0	1 890	1 890	0	0	3 110	3 110
o Export	50 662	0	22 548	26 611	0	0	28 114	24 051
o Economic Growth (Tricil)	8 599	0	663	1 207	0	0	7 936	7 392
o Off-Site Dust Suppression	950	0	238	238	713	0	713	0
Total Existing	232 096	2 470	29 397	37 976	114 936	79 599	120 631	77 245
Enhanced Regulations								
o Public Landfill	33 232	0	0	5 479	4 348	0	33 232	24 366
o Private Landfill	58 363	0	0	8 591	35 048	0	58 363	20 847
o On-Site Landfill	109 170	0	0	27 293	44 857	0	109 170	48 235
o Off-Site Dust Suppression[3]	65 232	0	100	6 214	52 650	0	65 133	9 426
Total Enhanced	265 997	0	100	47 577	136 903	0	265 898	102 874
TOTAL	498 093	2 470	29 497	85 553	251 839	79 599	386 528	180 119

[1] This table summarizes the quantities from Tables 5 through 27. Quantities in each row may not sum to produce total quantities.

[2] High quantities are based on the lower end of the range of estimates presented in Table 1.

[3] Quantities in addition to those under current regulations.

[4] Quantities shown do not include quantities which will continue to go to existing waste management facilities (eg. Tricil).

TABLE 30

Waste Allocation Quantities
1992 Annual Tonnes (Low)[1,2,4]

SOURCE	QUANTITY	STORAGE	4Rs LIKELY	4Rs POTENTIAL	TREATMENT AND DISPOSAL ON-SITE MAXIMUM	ON-SITE MINIMUM	OFF-SITE MAXIMUM	OFF-SITE MINIMUM
Current Regulations								
o Site Cleanup & Decommissioning Waste	24 900	1 300	0	476	9 420	0	23 600	13 823
o MISA Residuals	34 457	0	804	2 411	23 461	15 198	18 455	8 745
o WPCP Wastes	68 956	0	2 518	2 518	64 873	64 072	2 366	1 564
o PCB's in Storage/Use	3 830	0	0	0	2 850	0	3 830	980
o Household	500	0	189	189	0	0	311	311
o Export	50 662	0	22 548	26 611	0	0	28 114	24 051
o Economic Growth (Tricil)	8 599	0	663	1 207	0	0	7 936	7 392
o Off-Site Suppression	950	0	238	238	713	0	713	0
Total Existing	192 854	1 300	26 960	33 650	101 317	79 270	85 325	56 866
Enhanced Regulations								
o Public Landfill	33 232	0	0	5 479	4 348	0	33 232	24 366
o Private Landfill	58 363	0	0	8 591	35 048	0	58 363	20 847
o On-Site Landfill	109 170	0	0	27 293	44 857	0	109 170	48 235
o Off-Site Dust Suppression[3]	65 232	0	100	6 214	52 650	0	65 133	9 426
Total Enhanced	265 997	0	100	47 577	136 903	0	265 898	102 874
TOTAL	458 851	1 300	27 060	81 227	238 220	79 270	351 223	159 740

[1] This table summarizes the quantities from Tables 5 through 27. Quantities in each row may not sum to produce total quantities.

[2] Low quantities are based on the lower end of the range of estimates presented in Table 1.

[3] Quantities in addition to those under current regulations.

[4] Quantities shown do not include quantities which will continue to go to existing waste management facilities (eg. Tricil).

TABLE 31

Waste Allocation Quantities
1997 Annual Tonnes (High)[1,2,4]

SOURCE	QUANTITY	STORAGE	4Rs LIKELY	4Rs POTENTIAL	TREATMENT AND DISPOSAL ON-SITE MAXIMUM	ON-SITE MINIMUM	OFF-SITE MAXIMUM	OFF-SITE MINIMUM
Current Regulations								
o Site Cleanup & Decommissioning Waste	47 000	2 470	0	892	17 805	0	44 530	26 056
o MISA Residuals	50 126	0	1 627	4 881	30 586	16 578	31 921	14 984
o WPCP Wastes	75 760	0	2 766	2 766	71 275	70 395	2 599	1 719
o PCB's in Storage/Use	500	0	0	0	0	0	500	500
o Household	5 000	0	1 890	1 890	0	0	3 110	3 110
o Export	56 430	0	25 115	29 641	0	0	31 315	26 789
o Economic Growth (Tricil)	16 940	0	1 308	2 380	0	0	15 633	14 560
o Off-Site Dust Suppression	1 050	0	263	263	788	0	788	0
Total Existing	252 806	2 470	32 969	42 713	120 454	86 973	130 396	87 718
Enhanced Regulations								
o PCB's in Use (high level)[3]	300	0	0	0	0	0	300	300
o Public Landfill	37 416	0	0	6 169	4 895	0	37 416	27 434
o Private Landfill	64 132	0	0	9 440	38 512	0	64 132	22 908
o On-Site Landfill	122 915	0	0	30 729	50 504	0	122 915	54 308
o Off-Site Dust Suppression[3]	73 304	0	112	6 983	59 164	0	73 192	10 592
Total Enhanced	298 067	0	112	53 321	153 075	0	297 955	115 542
TOTAL	550 873	2 470	33 081	96 034	273 529	86 973	428 351	203 260

[1] This table summarizes the quantities from Tables 5 through 27. Quantities in each row may not sum to produce total quantities.

[2] High quantities are based on the upper end of the range of estimates provided in Table 2.

[3] Quantities in addition to those under current regulations.

[4] Quantities shown do not include quantities which will continue to go to existing waste management facilities (eg. Tricil).

TABLE 32

Waste Allocation Quantities
1997 Annual Tonnes (Low)[1,2,4]

SOURCE	QUANTITY	STORAGE	4Rs LIKELY	4Rs POTENTIAL	TREATMENT AND DISPOSAL ON-SITE MAXIMUM	ON-SITE MINIMUM	OFF-SITE MAXIMUM	OFF-SITE MINIMUM
Current Regulations								
o Site Cleanup & Decommissioning Waste	24 900	1 300	0	476	9 420	0	23 600	13 823
o MISA Residuals	36 669	0	848	2 543	25 006	16 226	19 595	9 289
o WPCP Wastes	75 760	0	2 766	2 766	71 275	70 395	2 599	1 719
o PCB's in Storage/Use	500	0	0	0	0	0	500	500
o Household	500	0	189	189	0	0	311	311
o Export	56 430	0	25 115	29 641	0	0	31 315	26 789
o Economic Growth (Tricil)	16 940	0	1 308	2 380	0	0	15 633	14 560
o Off-Site Dust Suppression	1 050	0	263	263	787	0	787	0
Total Existing	212 749	1 300	30 489	38 258	106 488	86 621	94 340	66 991
Enhanced Regulations								
o PCB's in Use (high level)[3]	300	0	0	0	0	0	300	300
o Public Landfill	37 416	0	0	6 169	4 895	0	37 416	27 434
o Private Landfill	64 132	0	0	9 440	38 512	0	64 132	22 908
o On-Site Landfill	122 915	0	0	30 729	50 504	0	122 915	54 308
o Off-Site Dust Suppression[3]	73 304	0	112	6 983	59 164	0	73 192	10 592
Total Enhanced	298 067	0	112	53 321	153 075	0	297 955	115 542
TOTAL	510 816	1 300	30 601	91 579	259 563	86 621	392 295	182 533

[1] This table summarizes the quantities from Tables 5 through 27. Quantities in each row may not sum to produce total quantities.

[2] Low quantities are based on the lower end of the range of estimates provided in Table 2.

[3] Quantities in addition to those under current regulations.

[4] Quantities shown do not include quantities which will continue to go to existing waste management facilities (eg. Tricil).

8. REGIONAL DISTRIBUTION OF WASTE ALLOCATION QUANTITIES

The waste allocation quantities developed throughout this report and summarized in Section 7.14 identified the potential demand for additional off-site treatment and disposal capacity. These quantities were used in a variety of analyses in Volume II of the Environmental Assessment report including, a review of wastes, by region, requiring additional off-site treatment and disposal capacity. This necessitated the development of a county based geographic distribution, by OWMC waste class, of these waste allocation quantities.

The basis for the geographic distribution was the data termed "potential waste quantities seeking off-site treatment and disposal". These data are made up of waste going to the 13 destinations presented in Tables 1 and 2. The general approach was to take the geographic distribution of each waste stream and factor them down pro-rata to match the waste allocation quantity for that waste stream.

VHB Research and Consulting Inc. provided the geographic distribution for each waste stream representing the "potential waste quantities seeking off-site treatment and disposal". This included waste streams derived from the MOE Manifest and Generator databases and for waste streams estimated by independent consultant studies.

The geographic distribution for the waste streams derived from the MOE Manifest Database, namely, WPCP, public landfill, private landfill, export and off-site dust suppression, were based on the "generator file". The "receiver file", which VHB Research and Consulting Inc. used to help develop Tables 1 and 2, does not contain precise information on the geographic location of the waste generated.

The geographic distribution for the on-site landfill stream was based on MOE Generator Database, while the distribution for economic growth (based on Tricil at thermal capacity) was based on 1986 "manufacturing value added" by county.

For the waste streams developed by independent consultant studies, namely; PCBs, MISA, household and site cleanup and decommissioning wastes, the basis for the geographic distribution varied. The geographic distribution for PCB waste was based on the current inventory "in storage" and "in use" while household wastes were proportioned according to the number of households per county, in Ontario. MISA and site cleanup and decommissioning wastes were distributed according to the 1986 "manufacturing value added" in Ontario.

The waste quantities by county and OWMC class, for the 11 waste streams included in the waste allocation quantities, were factored down pro-rata to their off-site minimum and maximum quantities. This assumes that the geographic distribution of waste, by OWMC class, remains the same after the following steps:

1. The waste quantities potentially seeking off-site treatment and disposal are reduced by the quantities going to existing facilities. This identifies the input quantities to the waste allocation process;

2. The waste allocation quantities are reduced by applying the assumptions for 4Rs, storage and on-site treatment. This produces the minimum and maximum allocation to off-site treatment and disposal.

Using the above approach, the geographic distribution of individual waste streams were derived. These quantities were aggregated and the maximum and minimum allocations to off-site treatment and disposal for the 1992 high quantity estimates are presented in Tables 33 and 34.

TABLE 33

Regional Distribution of 1992
Maximum Off-Site Waste Allocation Quantities (t/a)[1,2]

COUNTY/REGION CODE		ONTARIO WASTE CLASS													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	TOTAL
1	Essex	179	1 011	770	1 331	2 367	9 484	244	36	387	0	46	7	79	2 018	17 959
2	Kent	60	81	30	596	896	1 286	78	521	50	0	140	5	17	640	4 399
3	Lambton	836	8 027	101	250	45 143	9 443	4 626	27 155	110	3 450	13 777	38	23	929	113 909
4	Middlesex	68	137	72	0	552	764	81	98	60	0	32	8	63	768	2 704
5	Elgin	37	51	11	0	302	410	45	64	33	0	0	2	4	421	1 379
7	Oxford	37	35	14	0	185	15 742	28	32	21	0	0	2	17	260	16 372
10	Brant	41	54	17	0	302	295	45	93	33	0	333	2	27	422	1 665
11	Haldiman-Norfolk	26	80	35	0	522	631	31	38	23	0	1 213	2	44	293	2 940
13	Niagara	152	198	199	111	2 666	2 104	190	205	849	0	1 182	9	118	1 551	9 532
13	Hamilton-Wentworth	169	248	371	2 257	15 298	7 229	629	610	150	0	704	34	126	1 927	29 753
14	Waterloo	682	313	73	27	1 176	2 266	4 932	651	132	0	677	20	97	1 492	12 537
15	Perth	32	32	11	0	178	210	27	6	21	0	36	2	4	252	811
16	Huron	7	15	11	0	59	61	9	3	6	0	0	2	4	82	258
17	Wellington	124	72	27	0	403	466	266	18	44	0	9 943	3	35	556	3 956
18	Dufferin	4	7	5	14	32	32	5	1	4	0	0	1	2	45	150
21	Halton	86	131	83	11	707	956	99	1 513	194	13	38	6	48	866	4 751
22	Peel	295	2 303	256	15	2 141	4 529	219	273	152	0	94	12	110	1 940	12 339
23	York	88	122	52	0	726	819	171	211	69	0	338	7	57	882	3 543
25	Simcoe	47	83	69	0	383	418	57	13	42	0	167	6	22	540	1 868
26	Grey	15	32	16	0	128	209	26	24	14	0	0	2	6	174	645
27	Bruce	15	26	14	0	121	201	18	4	13	0	6	2	30	169	627
28	Toronto	781	1 210	486	98	6 488	6 675	910	264	630	0	1 026	52	2 214	8 101	28 936
31	Northumberland	22	33	15	0	189	208	27	35	141	0	39	2	10	250	972
32	Victoria	5	13	12	0	40	37	20	4	4	0	0	2	3	55	195
33	Haliburton	1	5	8	0	4	4	1	2	0	0	0	1	1	6	33
34	Peterborough	20	37	24	0	160	337	24	6	94	0	15	4	49	227	996
35	Prince Edward	2	16 056	40	0	30 750	19	3	1	2	0	0	1	1	27	46 912
36	Hastings	149	74	21	0	266	308	43	6	29	0	4	3	15	389	1 309
37	Lennox and Addington	5	9	6	0	38	36	6	2	4	0	0	1	14	53	174
38	Frontenac	20	36	26	0	664	1 892	28	6	17	0	66	4	29	365	3 152
39	Durham	151	234	62	2	1 300	1 362	190	14	249	0	402	7	135	1 735	5 851
41	Renfrew	14	33	17	0	113	107	17	5	12	0	23	2	3	154	503
44	Leeds and Grenville	32	91	17	1	287	521	45	5	28	0	0	2	9	365	1 404
45	Lanark	16	16	9	0	79	67	11	10	8	0	0	1	2	101	321
46	Ottawa-Carleton	37	145	110	0	465	284	53	318	161	0	0	15	108	510	2 207
47	Prescott and Russell	9	16	9	0	73	69	11	2	8	0	7 506	1	3	113	7 821
48	Stormont, Dundas, & Glengarry	29	138	19	0	618	239	494	78	26	0	6	2	8	330	1 987
51	Muskoka	7	17	16	28	57	57	8	14	6	0	0	2	5	80	298
52	Parry Sound	1	7	11	0	8	7	:	3	1	0	0	2	8	11	61
53	Nipissing	48	17	23	0	70	266	10	4	8	0	0	2	25	98	572
54	Sudbury & District	6	23	28	0	45	42	7	8	5	0	0	4	61	62	289
55	Manitoulin	0	1	2	0	0	0	0	1	0	0	0	0	1	1	6
56	Algoma	33	52	32	0	269	21 484	40	6	30	0	0	3	49	375	22 373
57	Timiskaming	15	8	21	0	32	30	5	2	3	0	0	1	10	44	171
58	Cochrane	15	2 731	22	0	124	117	18	4	14	0	0	2	28	173	3 247
59	Thunder Bay	32	139	284	0	406	6 725	357	9	29	0	4 815	4	70	364	13 213
60661	Kenora & Rainy River	14	23	30	0	117	110	17	3	13	0	910	2	24	163	1 427
	TOTAL	4 466	34 221	3 587	4 741	116 957	98 558	14 170	32 381	3 941	3 463	35 541	292	3 830	30 381	386 529

[1] Based on the 1992 maximum waste allocation quantities seeking off-site treatment and disposal presented in Table 29.
[2] Numbers may not sum to given totals due to rounding.

TABLE 34

Regional Distribution of 1992
Minimum Off-Site Waste Allocation Quantities (t/a)[1,2]

COUNTY/REGION CODE		ONTARIO WASTE CLASS													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	TOTAL
1	Essex	117	885	666	1 139	1 493	6 917	172	27	299	0	34	7	20	1 181	12 957
2	Kent	40	76	27	437	525	846	55	387	47	0	103	4	4	374	2 926
3	Lambton	467	2 958	62	183	18 613	4 191	1 827	11 314	92	1 524	7 164	29	8	543	48 974
4	Middlesex	44	128	70	0	283	450	57	83	56	0	26	8	16	451	1 673
5	Elgin	24	48	11	0	154	251	31	48	31	0	0	2	1	246	847
7	Oxford	25	34	14	0	95	6 973	19	25	19	0	0	2	4	152	7 363
10	Brant	27	51	17	0	154	150	31	70	31	0	244	2	7	247	1 033
11	Haldimand-Norfolk	17	68	30	0	336	428	22	29	21	0	536	2	11	171	1 674
13	Niagara	100	187	177	94	1 810	1 407	135	155	594	0	712	9	30	912	6 320
13	Hamilton-Wentworth	111	230	226	324	3 682	5 416	462	457	140	0	520	28	32	1 133	12 761
14	Waterloo	451	275	56	4	625	1 539	4 058	558	122	0	543	17	25	474	9 148
15	Perth	22	31	11	0	91	115	19	5	19	0	27	2	1	148	491
16	Huron	5	14	11	0	30	32	6	3	6	0	0	2	1	48	157
17	Wellington	67	68	26	0	207	256	194	15	41	0	1 425	3	9	325	2 636
18	Dufferin	3	7	5	2	17	16	3	1	3	0	0	1	0	27	84
21	Halton	57	122	57	2	372	579	70	582	147	9	28	6	12	508	2 549
22	Peel	168	1 990	137	2	1 004	2 795	154	226	141	0	69	12	28	1 143	7 868
23	York	59	116	52	0	368	487	132	159	64	0	269	7	15	517	2 244
25	Simcoe	31	79	62	0	196	224	40	13	39	0	74	6	6	317	1 087
26	Grey	10	30	16	0	66	127	18	19	13	0	0	2	2	102	404
27	Bruce	10	25	14	0	62	121	13	4	12	0	5	2	10	99	375
28	Toronto	519	1 129	426	14	3 041	3 765	645	232	584	0	487	52	567	4 807	16 267
31	Northumberland	15	31	14	0	97	118	19	26	98	0	33	2	2	146	603
32	Victoria	3	12	12	0	20	19	16	4	4	0	0	2	1	32	126
33	Haliburton	0	5	8	0	2	2	0	2	0	0	0	1	0	3	25
34	Peterborough	13	35	24	0	82	223	17	6	67	0	12	4	13	134	628
35	Prince Edward	2	2 303	10	0	4 412	9	2	1	2	0	0	1	0	16	6 757
36	Hastings	106	68	21	0	136	168	31	6	27	0	3	3	4	233	806
37	Lennox and Addington	3	9	6	0	19	18	4	2	4	0	0	1	4	31	101
38	Frontenac	13	35	25	0	302	938	20	6	16	0	48	4	7	252	1 668
39	Durham	99	218	59	1	682	739	133	14	207	0	184	7	35	1 024	3 402
41	Renfrew	9	31	17	0	58	54	12	5	12	0	10	2	1	92	302
44	Leeds and Grenville	21	82	17	1	153	360	33	5	26	0	0	2	2	214	917
45	Lanark	11	15	9	0	42	34	7	8	7	0	0	1	1	60	196
46	Ottawa-Carleton	24	136	110	0	291	144	38	265	141	0	0	15	28	323	1 515
47	Prescott and Russell	6	16	9	0	37	35	8	2	7	0	3 316	1	1	69	3 508
48	Stormont, Dundas, & Glengarry	19	119	19	0	376	126	417	67	24	0	4	2	2	193	1 368
51	Muskoka	5	17	16	4	29	30	6	11	6	0	0	2	1	47	173
52	Parry Sound	1	7	11	0	4	4	1	3	1	0	0	2	2	5	42
53	Nipissing	35	16	20	0	36	180	7	4	7	0	0	2	6	54	371
54	Sudbury & District	4	22	28	0	23	21	5	8	5	0	0	4	16	36	171
55	Manitoulin	0	1	2	0	0	0	0	1	0	0	0	0	0	0	4
56	Algoma	22	45	26	0	137	9 508	28	6	27	0	0	3	13	219	10 039
57	Timiskaming	11	8	17	0	16	15	3	2	3	0	0	1	3	26	105
58	Cochrane	10	412	20	0	63	59	13	4	13	0	0	2	7	101	704
59	Thunder Bay	21	63	229	0	202	2 869	261	9	27	0	2 127	4	18	213	6 042
60&61	Kenora & Rainy River	9	22	27	0	60	56	12	3	12	0	402	2	6	95	707
	TOTAL	2 835	12 282	2 928	2 206	40 506	52 818	9 257	14 883	3 266	1 534	18 404	272	980	17 950	180 119

[1] Based on the 1992 minimum waste allocation quantities seeking off-site treatment and disposal presented in Table 29.

[2] Numbers may not sum to given totals due to rounding.

9. USE OF ALLOCATION QUANTITIES FOR WASTE PROFILE GENERATION

Waste profiles were developed to depict the "best assessment" of the makeup of wastes destined to an OWMC facility in a typical year. They were used as the basis for many aspects of facility design, site selection and site planning. In earlier phases of this project, the marketing staff of OWMC undertook the development of these profiles. The sources of knowledge of waste generation and management available included:

- Proctor and Redfern, Waste Quantities Study, 1982;
- Canviro, Survey of 1000 Companies, 1983;
- background material such as the Working Session on Waste Classification;
- Dillon, Classification of Special Waste, 1984;
- MOE Waybill;
- Staff expertise on waste generation in specific market sectors with which they were knowledgeable.

The November 1984 profile was used as the benchmark for much of the analyses in the Environmental Assessment report. It has been noted and acknowledged that the profile was the best estimate of wastes based on available data, but that there was a high potential for considerable variation in the actual waste received at the plant.

With the emergence of; the Manifest database, estimates of waste quantities not captured in the Manifest database from independent studies, and the waste allocation exercise, it was realized that the profile generation process could be supported with better data. In particular, the waste quantities allocated to off-site treatment and disposal are candidates for input to the process since they represent the wastes which OWMC could be required to handle. Consequently, the marketing staff of OWMC developed the methodologies used in the generation of new waste profiles[1]. The methodologies were built upon the concepts of "Nastiness" and "Treatability".

The Nastiness and Treatability Indices (NTI) were derived by assigning values, between 0 and 1 for "Nastiness" (N) and between 1 and 10 for (difficulty of) "Treatability" (T). The NTI is calculated for each UCD as 10N + T. The factor 10, therefore, normalizes the relative scales such that each is equally weighted. The two factors were determined by OWMC for each UCD class.

On the basis of the NTI, a methodology for profile generation was detailed and termed the November 1988 profiles. The key assumptions in developing the November 88 profiles are:

1. that there be a minimum quantity (of 5 tonnes) in each UCD class.

2. that all wastes flow to the plant in proportion to the Nastiness-Treatability index.

3. that the total quantities of wastes going to incineration and Phys/Chem equal the design capacities, i.e. 30/120 in the 150,000 tonnes/annum profile.

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[1] See D. Miner's memo dated 30 August 1988.

The general equation for allocating the waste (by UCD), given these constraints, is:

$$Q_{UCD} = (ION + T)_{UCD} * Q_{TOTAL} / \sum_{\substack{All \\ UCD's}} (ION + T)_{UCD}$$

where: Q_{UCD} = quantity of UCD
Q_{TOTAL} = plant capacity
(ION+T) = Nastiness-Treatability index value

The November 1988 profiles will be used for sensitivity tests against prior decisions made based on November 1984 profiles.

The allocation quantities, by UCD classes, resulting from the waste allocation workshop were used as input data to an automated profile generation process. In addition to the maximum and minimum allocation quantities, an average scenario was developed by averaging the maximum and minimum quantities per UCD class. In each case, a design capacity of 150 000 t/a (120 000 t/a Phys/Chem and 30 000 t/a incinerator) was assumed. The three sets of profiles generated are summarized in Table 35. It should be noted that the profile developed based on the minimum allocation quantities did not achieve a full 150 000 t/a profile. There were insufficient inorganic wastes in the input quantities to fill a 120 000 t/a physical/chemical [illegible] plant in 1992.

TABLE 35

November 1988 Waste Profiles[1]

OWMC WASTE CLASS	MAXIMUM OFF-SITE WASTE QUANTITIES (t/a)	AVERAGE OFF-SITE WASTE QUANTITIES (t/a)	MINIMUM OFF-SITE WASTE QUANTITIES (t/a)[2]
1	6 041	5 617	5 469
2	5 748	5 829	5 700
3	790	805	904
4	5	5	5
5	12 650	10 106	8 052
6	74 060	66 878	30 415
7	12 156	9 343	6 700
8	9 416	9 474	9 602
9	4 153	4 026	3 899
10	15	15	15
11	19 822	32 711	42 275
12	573	527	481
13	2 034	2 076	980
14	2 537	2 587	2 903
TOTAL	150 000	150 000	117 398

[1] These profiles were based on the 1992 estimates of maximum and minimum waste quantities seeking off-site treatment and disposal.

[2] There were insufficient inorganic waste quantities in 1992 to fill the profile.

APPENDIX A

MARKET ASSESSMENT MODEL

The market assessment model (Victor and Burrell, 1985) determined simulated waste flows by examining wastes by source (e.g. waste currently going to public landfills) and predicting the decisions likely to be made by individual generators regarding management of their waste. Each firm was given a range of waste management choices based on the waste types generated.

The effects of these decisions, in terms of waste types, quantities and destinations were aggregated to obtain allocation estimates for the entire population of waste generators. The individual decisions were based on a least cost decision rule. Cost, in this case, included only direct expenditures (e.g., disposal fees, transport costs) and not indirect costs (e.g., public image, liability).

The model consists of a series of submodels. The "legal fates submodel" determines which waste type/fate combinations are legal using the UCD waste classification scheme (considering both on-site and off-site destinations). The "off-site disposal cost submodel" combines the off-site disposal fees and related transport costs to estimate total off-site disposal costs. The "least cost option submodel" consists of a minimization search routine for each stream. The results consist of an allocation of each firm's waste to generic destinations. The final submodel, "aggregation", aggregates the individual firm results to produce provincial totals.

There are a number of critical assumptions in the model that were essential to make the waste flow system manageable. Four are of potential interest here. First, the decision rule utilized is somewhat simplistic (based solely on cost). Factors such as perceived reliability, technical sophistication requirements, public image and liability are not considered. These issues could have a significant bearing on other choices such as 4Rs versus treatment and disposal and on-site versus off-site management.

Second, the model lacks historical consistency which is particularly relevant for on-site treatment and disposal. Decisions made in the model are assumed to take full effect for a five-year period at which time all past decisions are revisited. A particular problem results from on-site choices being made based on annualized capital and operating cost. It is possible to select an on-site treatment technology initially and change to another technology in five years time. This change can therefore occur prior to the end of the useful life of the initial technology (used in the annualizing of the capital cost). The costs used for decision-making in the model can be understated. In reality, there would be a greater economic disincentive to switch technologies. Another problem, along this vein, is that long-term contracts are not considered (i.e., generators may be tied to certain destinations for a long period of time).

Third, the model assumes full information and immediate response by waste generators. This does not accurately reflect the decision lags that are common in waste management practice. Finally, the model bases its choices on UCD waste class distinctions. The input to the model, however, is waste flows aggregated based on the MOE waste classification. While the correlation between MOE and UCD classes is for the most part reasonable, there are some UCD classes which contain only a portion of the corresponding MOE classes (see Table A.1 for definition of waste classes and correlation between these two and the OWMC system). Therefore, in some instances, the model makes waste management choices for given waste flows considering technologies that are not entirely appropriate.

TABLE A.1

Waste Classification Conversions

Waste Classification Classes				MOE Description
	MOE	UCD	OWMC	
1	111	133	6	Spent pickle liquor
2	112	111	6	Acid waste - heavy metals
3	113	112	6	Acid waste - other metals
4	114	113	6	Other inorganic acid wastes
5	121	121	6	Alkaline waste - heavy metals
6	122	122	6	Alkaline waste - other metals
7	123	123	6	Alkaline phosphates
8	131	141	6	Neutralized waste - heavy metals
9	132	417	11	Neutralized waste - other metals
10	133	145	7	Brines, chlor-alkali wastes
11	134	147	10	Sulphide-containing wastes
12	135	143	6	Reactive anion wastes
13*	141	431	6	Inorganic pigment wastes
14	142	431	6	Smelting wastes
15	143	288	5	Steel making residues
16	144	251	6	Inorganic tannery wastes
17	145	454	8	Paint/pigment/coating residues
18	146	151	11	Other specified inorganics
19	147	142	6	Chemical fertilizer wastes
20	148	152	7	Inorganic laboratory chemicals
21	149	225	9	Landfill leachates
22	150	167	11	Inert inorganic wastes
23	211	214	2	Aromatic solvents
24	212	214	2	Aliphatic solvents
25	213	214	2	Petroleum distillates
26	221	281	3	Light fuels
27	222	258	8	Heavy fuels
28	231	262	8	Latex wastes
29	232	261	1	Polymeric resins
30	233	263	1	Other polymeric wastes
31	241	211	2	Halogenated solvents
32	242	241	12	Halogenated pesticides
33	243	242	13	PCBs
34	251	282	5	Oil skimmings and sludges
35	252	281	3	Waste oils and lubricants
36	253	289	5	Emulsified oils
37	254	284	5	Transfer station oil wastes
38	261	243	7	Pharmaceuticals
39*	262	225	9	Detergents/soaps
40	263	245	7	Organic laboratory chemicals
41	264	244	6	Photoprocessing wastes
42	265	254	8	Graphic art wastes
43	266	257	1	Phenolic wastes

TABLE A.1

Waste Classification Conversions

(continued)

Waste Classification Classes				MOE Description
	MOE	UCD	OWMC	
44	267	224	2	Organic acids
45	268	224	2	Amines
46	269	241	12	Non-halogenated pesticides
47*	270	523	1	Other specified organics
48*	270	523	6	Other specified inorganics
49	281	227	9	Non-halogenated rich organics
50	282	225	9	Non-halogenated lean organics
51	311	252	1	Organic tannery wastes
52	312	528	14	Pathological wastes
53	321	0	14	Explosive manufacturing wastes
54	331	509	11	Waste compressed gases

Note: * indicates the waste class of which the mapping has been revised since release of earlier versions of this report.

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